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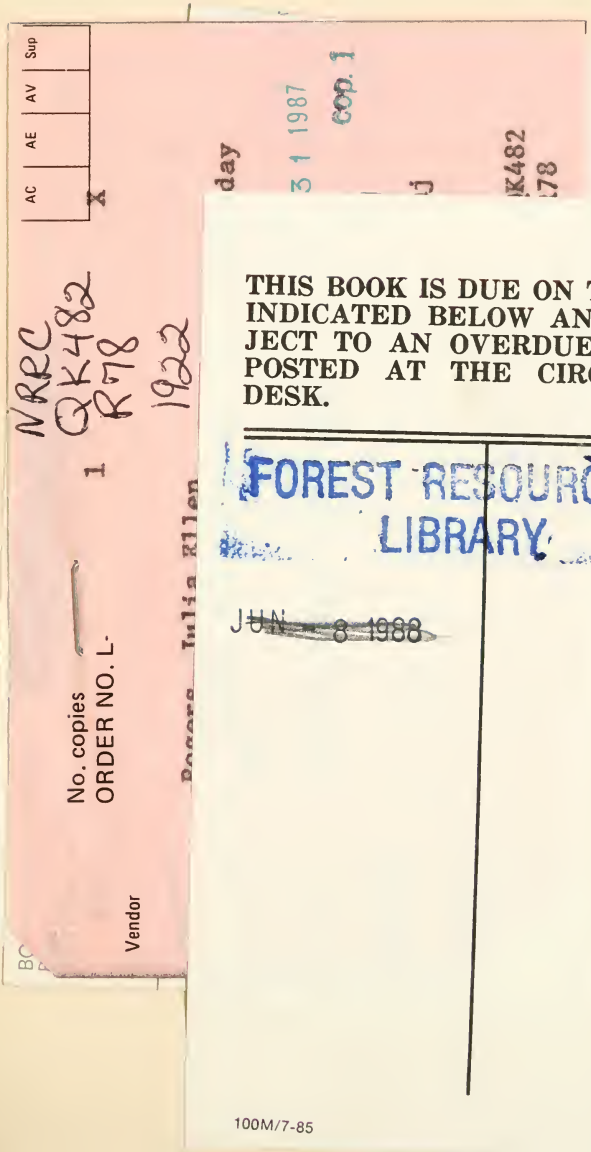

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TREES WORTH KNOWING

A BEND IN THE TRAIL

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TREES WORTH KNOWING

BY JULIA ELLEN ROGERS

(*Author of The Tree Book, The Tree Guide, Trees Every Child Should Know, The Book of Useful Plants, The Shell Book, etc., etc.*)

With forty-eight illustrations, sixteen being in color

FIRST PRESBYTERIAN CHURCH
WESTFIELD, NEW YORK

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INTRODUCTION

INTRODUCTION

Occasionally I meet a person who says: "I know nothing at all about trees." This modest disclaimer is generally sincere, but it has always turned out to be untrue. "Oh, well, that old sugar maple, I've always known that tree. We used to tap all the sugar maples on the place every spring." Or again: "Everybody knows a white birch by its bark." "Of course, anybody who has ever been chestnutting knows a chestnut tree." Most people know Lombardy poplars, those green exclamation points so commonly planted in long soldierly rows on roadsides and boundary lines in many parts of the country. Willows, too, everybody knows are willows. The best nut trees, the shagbark, chestnut, and butternut, need no formal introduction. The honey locust has its striking three-pronged thorns, and its purple pods dangling in winter and skating off over the snow. The beech has its smooth, close bark of Quaker gray, and nobody needs to look for further evidence to determine this tree's name.

So it is easily proved that each person has a good nucleus of tree knowledge around which to accumulate more. If people have the love of nature in their hearts—if things out of doors call irresistibly, at any season—it will not really matter if their lives are pinched and circumscribed. Ways and means of studying trees are easily found, even if the scant ends of busy days spent indoors are all the time at

command. If there is energy to begin the undertaking it will soon furnish its own motive power. Tree students, like bird students, become enthusiasts. To understand their enthusiasm one must follow their examples.

The beginner doesn't know exactly how and where to begin. There are great collections of trees here and there. The Arnold Arboretum in Boston is the great dendrological Noah's Ark in this country. It contains almost all the trees, American and foreign, which will grow in that region. The Shaw Botanical Garden at St. Louis is the largest midland assemblage of trees. Parks in various cities bring together as large a variety of trees as possible, and these are often labelled with their English and botanical names for the benefit of the public.

Yet the places for the beginner are his own dooryard, the streets he travels four times a day to his work, and woods for his holiday, though they need not be forests. Arboreta are for his delight when he has gained some acquaintance with the tree families. But not at first. The trees may all be set out in tribes and families and labelled with their scientific names. They will but confuse and discourage him. There is not time to make their acquaintance. They overwhelm with the mere number of kinds. Great arboreta and parks are very scarce. Trees are everywhere. The acquaintance of trees is within the reach of all.

First make a plan of the yard, locating and naming the trees you actually know. Extend it to include the street, and the neighbors' yards, as you get ready for them. Be very careful about giving names to trees. If you think you know a tree, ask yourself *how* you know it. Sift out all the guesses, and the hearsays, and begin on a solid founda-

tion, even if you are sure about only the sugar maple and the white birch.

The characters to note in studying trees are: leaves, flowers, fruits, bark, buds, bud arrangement, leaf scars, and tree form. The season of the year determines which features are most prominent. Buds and leaf scars are the most unvarying of tree characters. In winter these traits and the tree frame are most plainly revealed. Winter often exhibits tree fruits on or under the tree, and dead-leaf studies are very satisfactory. Leaf arrangement may be made out at any season, for leaf scars tell this story after the leaves fall.

Only three families of our large trees have opposite leaves. This fact helps the beginner. Look first at the twigs. If the leaves, or (in winter) the buds and leaf scars, stand opposite, the tree (if it is of large size) belongs to the maple, ash, or horse-chestnut family. Our native horse-chestnuts are buckeyes. If the leaves are simple the tree is a maple; if pinnately compound, of several leaflets, it is an ash; if palmately compound, of five to seven leaflets, it is a horse-chestnut. In winter dead leaves under the trees furnish this evidence. The winter buds of the horse-chestnut are large and waxy, and the leaf scars look like prints of a horse's hoof. Maple buds are small, and the leaf scar is a small, narrow crescent. Ash buds are dull and blunt, with rough, leathery scales. Maple twigs are slender. Ash and buckeye twigs are stout and clumsy.

Bark is a distinguishing character of many trees—of others it is confusing. The sycamore, shedding bark in sheets from its limbs, exposes pale, smooth under bark. The tree is recognizable by its mottled appearance winter or summer. The corky ridges on limbs of sweet gum and

bur oak are easily remembered traits. The peculiar horizontal peeling of bark on birches designates most of the genus. The prussic-acid taste of a twig sets the cherry tribe apart. The familiar aromatic taste of the green twigs of sassafras is its best winter character; the mitten-shaped leaves distinguish it in summer.

It is necessary to get some book on the subject to discover the names of trees one studies, and to act as teacher at times. A book makes a good staff, but a poor crutch. The eyes and the judgment are the dependable things. In spring the way in which the leaves open is significant; so are the flowers. Every tree when it reaches proper age bears flowers. Not all bear fruit, but blossoms come on every tree. In summer the leaves and fruits are there to be examined. In autumn the ripening fruits are the special features.

To know a tree's name is the beginning of acquaintance —not an end in itself. There is all the rest of one's life in which to follow it up. Tree friendships are very precious things. John Muir, writing among his beloved trees of the Yosemite Valley, adjures his world-weary fellow men to seek the companionship of trees.

"To learn how they live and behave in pure wildness, to see them in their varying aspects through the seasons and weather, rejoicing in the great storms, putting forth their new leaves and flowers, when all the streams are in flood, and the birds singing, and sending away their seeds in the thoughtful Indian summer, when all the landscape is glowing in deep, calm enthusiasm—for this you must love them and live with them, as free from schemes and care and time as the trees themselves."

Tree Names

Two Latin words, written in italics, with a cabalistic abbreviation set after them, are a stumbling block on the page to the reader unaccustomed to scientific lore. He resents botanical names, and demands to know the tree's name in "plain English." Trees have both common and scientific names, and each has its use. Common names were applied to important trees by people, the world over, before science was born. Many trees were never noticed by anybody until botanists discovered and named them. They may never get common names at all.

A name is a description reduced to its lowest terms. It consists usually of a surname and a descriptive adjective: Mary Jones, white oak, *Quercus alba.* Take the oaks, for example, and let us consider how they got their names, common and scientific. All acorn-bearing trees are oaks. They are found in Europe, Asia, and America. Their usefulness and beauty have impressed people The Britons called them by a word which in our modern speech is *oak*, and as they came to know the different kinds, they added a descriptive word to the name of each. But "plain English" is not useful to the Frenchman. *Chêne* is his name for the acorn trees. The German has his *Eichenbaum*, the Roman had his *Quercus*, and who knows what the Chinaman and the H ndoo in far Cathay or the American Indian called these trees? Common names made the trouble when the Tower of Babel was building.

Latin has always been the universal language of scholars. It is dead, so that it can be depended upon to remain unchanged in its vocabulary and in its forms and usages. Scientific names are exact, and remain unchanged, though

an article or a book using them may be translated into all the modern languages. The word *Quercus* clears away difficulties. French, English, German hearers know what trees are meant—or they know just where in books of their own language to find them described.

The abbreviation that follows a scientific name tells who first gave the name. "Linn." is frequently noticed, for Linnaeus is authority for thousands of plant names.

Two sources of confusion make common names of trees unreliable: the application of one name to several species, and the application of several names to one species. To illustrate the first: There are a dozen ironwoods in American forests. They belong, with two exceptions, to different genera and to at least five different botanical families. To illustrate the second: The familiar American elm is known by at least seven local popular names. The bur oak has seven. Many of these are applied to other species. Three of the five native elms are called water elm; three are called red elm; three are called rock elm. There are seven scrub oaks. Only by mentioning the scientific name can a writer indicate with exactness which species he is talking about. The unscientific reader can go to the botanical manual or cyclopedia and under this name find the species described.

In California grows a tree called by three popular names: leatherwood, slippery elm, and silver oak. Its name is *Fremontia*. It is as far removed from elms and oaks as sheep are from cattle and horses. But the names stick. It would be as easy to eradicate the trees, root and branch, from a region as to persuade people to abandon names they are accustomed to, though they may concede that you have proved these names incorrect, or meaning-

less, or vulgar. Nicknames like nigger pine, he huckleberry, she balsam, and bull bay ought to be dropped by all people who lay claim to intelligence and taste.

With all their inaccuracies, common names have interesting histories, and the good ones are full of helpful suggestion to the learner. Many are literal translations of the Latin names. The first writers on botany wrote in Latin. Plants were described under the common name, if there was one; if not, the plant was named. The different species of each group were distinguished by the descriptions and the drawings that accompanied them. Linnaeus attempted to bring the work of botanical scholars together, and to publish descriptions and names of all known plants in a single volume. This he did, crediting each botanist with his work. The "Species Plantarum," Linnaeus's monumental work, became the foundation of the modern science of botany, for it included all the plants known and named up to the time of its publication. This was about the middle of the eighteenth century.

The vast body of information which the "Species Plantarum" contained was systematically arranged. All the different species in one genus were brought together. They were described, each under a number; and an adjective word, usually descriptive of some marked characteristic, was written in as a marginal index.

After Linnaeus's time botanists found that the genus name in combination with this marginal word made a convenient and exact means of designating the plant. Thus Linnaeus became the acknowledged originator of the binomial (two-name) system of nomenclature now in use in all sciences. It is a delightful coincidence that while Linnaeus was engaged on his great work, North America,

that vast new field of botanical exploration, was being traversed by another Swedish scientist. Peter Kalm sent his specimens and his descriptive notes to Linnaeus, who described and named the new plants in his book. The specimens swelled the great herbarium at the University of Upsala.

Among trees unknown to science before are the Magnolia, named in honor of the great French botanist, Magnol. Robinia, the locust, honors another French botanist, Robin, and his son. Kalmia, the beautiful mountain laurel, immortalizes the name of the devoted explorer who discovered it.

Inevitably, duplication of names attended the work of the early scientists, isolated from each other, and far from libraries and herbaria. Any one discovering a plant he believed to be unknown to science published a description of it in some scientific journal. If some one else had described it at an earlier date, the fact became known in the course of time. The name earliest published is retained, and the later one is dropped to the rank of a *synonym*. If the *name* has been used before to describe some other species in the same genus, a new name must be supplied. In the "Cyclopedia of Horticulture" the sugar maple is written: "*Acer saccharum*, Marsh. (*Acer saccharinum*, Wang. *Acer barbatum*, Michx.)" This means that the earliest name given this tree by a botanist was that of Marshall. Wangheimer and Michaux are therefore thrown out; the names given by them are among the synonyms.

Our cork elm was until recently called "*Ulmus racemosa*, Thomas." The discovery that the name *racemosa* was given long ago to the cork elm of Europe discredited it for

the American tree. Mr. Sargent substituted the name of the author, and it now stands "*Ulmus Thomasi*, Sarg." Occasionally a generic name is changed. The old generic name becomes the specific name. Box elder was formerly known as "*Negundo aceroides*, Mœnch." It is changed back to "*Acer Negundo*, Linn." On the other hand, the tan-bark oak, which is intermediate in character between oaks and chestnuts, has been taken by Professor Sargent in his Manual, 1905, out of the genus *Quercus* and set in a genus by itself. From "*Quercus densiflora*, Hook. and Arn.," it is called "*Pasania densiflora*, Sarg.," the specific name being carried over to the new genus.

About one hundred thousand species of plants have been named by botanists. They believe that one half of the world's flora is covered. Trees are better known than less conspicuous plants. Fungi and bacteria are just coming into notice. Yet even among trees new species are constantly being described. Professor Sargent described 567 native species in his "Silva of North America," published 1892-1900. His Manual, 1905, contains 630. Both books exclude Mexico. The silva of the tropics contains many unknown trees, for there are still impenetrable tracts of forest.

The origin of local names of trees is interesting. History and romance, music and hard common sense are in these names—likewise much pure foolishness. The nearness to Mexico brought in the musical *piñon* and *madroña* in the southwest. *Pecanier* and *bois d'arc* came with many other French names with the Acadians to Louisiana. The Indians had many trees named, and we wisely kept hickory, wahoo, catalpa, persimmon, and a few others of them.

Woodsmen have generally chosen descriptive names

which are based on fact and are helpful to learners. Botanists have done this, too. Bark gives the names to shagbark hickory, striped maple, and naked wood. The color names white birch, black locust, blue beech. Wood names red oak, yellow-wood, and white-heart hickory. The texture names rock elm, punk oak, and soft pine. The uses name post oak, canoe birch, and lodge-pole pine.

The tree habit is described by dwarf juniper and weeping spruce. The habitat by swamp maple, desert willow, and seaside alder. The range by California white oak and Georgia pine. Sap is characterized in sugar maple, sweet gum, balsam fir, and sweet birch. Twigs are indicated in clammy locust, cotton gum, winged elm. Leaf linings are referred to in silver maple, white poplar, and white basswood. Color of foliage, in gray pine, blue oak, and golden fir. Shape of leaves, in heart-leaved cucumber tree and ear-leaved umbrella. Resemblance of leaves to other species, in willow oak and parsley haw. The flowers of trees give names to tulip tree, silver-bell tree, and fringe tree. The fruit is described in big-cone pine, butternut, mossy-cup oak, and mock orange.

Many trees retain their classical names, which have become the generic botanical ones, as acacia, ailanthus, and viburnum. Others modify these slightly, as pine from *Pinus*, and poplar from *Populus*. The number of local names a species has depends upon the notice it attracts and the range it has. The loblolly pine, important as a lumber tree, extends along the coast from New Jersey to Texas. It has twenty-two nicknames.

The scientific name is for use when accurate designation of a species is required; the common name for ordinary speech. "What a beautiful *Quercus alba!*" sounds very

silly and pedantic, even if it falls on scientific ears. Only persons of very shallow scientific learning use it on such informal occasions.

Let us keep the most beautiful and fitting among common names, and work for their general adoption. There are no hard names once they become familiar ones. Nobody hesitates or stumbles over chrysanthemum and rhododendron, though these sonorous Greek derivatives have four syllables. Nobody asks what these names are "in plain English."

TREES WORTH KNOWING

TREES

PART I

THE LIFE OF THE TREES

The swift unfolding of the leaves in spring is always a miracle. One day the budded twigs are still wrapped in the deep sleep of winter. A trace of green appears about the edges of the bud scales—they loosen and fall, and the tender green shoot looks timidly out and begins to unfold its crumpled leaves. Soon the delicate blade broadens and takes on the texture and familiar appearance of the grown-up leaf. Behold! while we watched the single shoot the bare tree has clothed itself in the green canopy of summer.

How can this miracle take place? How does the tree come into full leaf, sometimes within a fraction of a week? It could never happen except for the store of concentrated food that the sap dissolves in spring and carries to the buds, and for the remarkable activity of the cambium cells within the buds.

What is a bud? It is a shoot in miniature—its leaves or flowers, or both, formed with wondrous completeness in the previous summer. About its base are crowded leaves so hardened and overlapped as to cover and protect the tender shoot. All the tree can ever express of beauty or of energy comes out of these precious little "growing points," wrapped up all winter, but impatient, as spring

approaches, to accept the invitation of the south wind and sun.

The protective scale leaves fall when they are no longer needed. This vernal leaf fall makes little show on the forest floor, but it greatly exceeds in number of leaves the autumnal defoliation.

Sometimes these bud scales lengthen before the shoot spares them. The silky, brown scales of the beech buds sometimes add twice their length, thus protecting the lengthening shoot which seems more delicate than most kinds, less ready to encounter unguarded the wind and the sun. The hickories, shagbark, and mockernut, show scales more than three inches long.

Many leaves are rosy, or lilac tinted, when they open—the waxy granules of their precious "leaf green"screened by these colored pigments from the full glare of the sun. Some leaves have wool or silk growing like the pile of velvet on their surfaces. These hairs are protective also. They shrivel or blow away when the leaf comes to its full development. Occasionally a species retains the down on the lower surface of its leaves, or, oftener, merely in the angles of its veins.

The folding and plaiting of the leaves bring the ribs and veins into prominence. The delicate green web sinks into folds between and is therefore protected from the weather. Young leaves hang limp, never presenting their perpendicular surfaces to the sun.

Another protection to the infant leaf is the pair of stipules at its base. Such stipules enclose the leaves of tulip and magnolia trees. The beech leaf has two long strap-like stipules. Linden stipules are green and red—two concave, oblong leaves, like the two valves of a pea pod. Elm

stipules are conspicuous. The black willow has large, leaf-like, heart-shaped stipules, green as the leaf and saw-toothed.

Most stipules shield the tender leaf during the hours of its helplessness, and fall away as the leaf matures. Others persist, as is often seen in the black willows.

With this second vernal leaf fall (for stipules are leaves) the leaves assume independence, and take up their serious work. They are ready to make the living for the whole tree. Nothing contributed by soil or atmosphere—no matter how rich it is—can become available for the tree's use until the leaves receive and prepare it.

Every leaf that spreads its green blade to the sun is a laboratory, devoted to the manufacture of starch. It is, in fact, an outward extension of the living cambium, thrust out beyond the thick, hampering bark, and specialized to do its specific work rapidly and effectively.

The structure of the leaves must be studied with a microscope. This laboratory has a delicate, transparent, enclosing wall, with doors, called stomates, scattered over the lower surface. The "leaf pulp" is inside, so is the framework of ribs and veins, that not only supports the soft tissues but furnishes the vascular system by which an incoming and outgoing current of sap is kept in constant circulation. In the upper half of the leaf, facing the sun, the pulp is in "palisade cells," regular, oblong, crowded together, and perpendicular to the flat surface. There are sometimes more than one layer of these cells.

In the lower half of the leaf's thickness, between the palisade cells and the under surface, the tissue is spongy. There is no crowding of cells here. They are irregularly spherical, and cohere loosely, being separated by ample

air spaces, which communicate with the outside world by the doorways mentioned above. An ordinary apple leaf has about one hundred thousand of these stomates to each square inch of its under surface. So the ventilation of the leaf is provided for.

The food of trees comes from two sources—the air and the soil. Dry a stick of wood, and the water leaves it. Burn it now, and ashes remain. The water and the ashes came from the soil. That which came from the air passed off in gaseous form with the burning. Some elements from the soil also were converted by the heat into gases, and escaped by the chimneys.

Take that same stick of wood, and, instead of burning it in an open fireplace or stove, smother it in a pit and burn it slowly, and it comes out a stick of charcoal, having its shape and size and grain preserved. It is carbon, its only impurity being a trace of ashes. What would have escaped up a chimney as carbonic-acid gas is confined here as a solid, and fire can yet liberate it.

The vast amount of carbon which the body of a tree contains came into its leaves as a gas, carbon dioxide. The soil furnished various minerals, which were brought up in the "crude sap." Most of these remain as ashes when the wood is burned. Water comes from the soil. So the list of raw materials of tree food is complete, and the next question is: How are they prepared for the tree's use?

The ascent of the sap from roots to leaves brings water with mineral salts dissolved in it. Thus potassium, calcium, magnesium, iron, sulphur, nitrogen, and phosphorus are brought to the leaf laboratories—some are useful, some useless. The stream of water contributes of itself to the laboratory whatever the leaf cells demand to

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SHAGBARK HICKORY

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MOCKERNUT FRUIT AND LEAVES

keep their own substance sufficiently moist, and those molecules that are necessary to furnish hydrogen and oxygen for the making of starch. Water is needed also to keep full the channels of the returning streams, but the great bulk of water that the roots send up escapes by evaporation through the curtained doorways of the leaves.

Starch contains carbon, hydrogen, and oxygen, the last two in the exact proportion that they bear to each other in water, H^2O. The carbon comes in as carbon dioxide, CO^2. There is no lack of this familiar gas in the air. It is exhaled constantly from the lungs of every animal, from chimneys, and from all decaying substances. It is diffused through the air, and, entering the leaves by the stomates, comes in contact with other food elements in the palisade cells.

The power that runs this starch factory is the sun. The chlorophyll, or leaf green, which colors the clear protoplasm of the cells, is able to absorb in daylight (and especially on warm, sunny days) some of the energy of sunlight, and to enable the protoplasm to use the energy thus captured to the chemical breaking down of water and carbon dioxide, and the reuniting of their free atoms into new and more complex molecules. These are molecules of starch, $C^6H^{10}O^5$.

The new product in soluble form makes its way into the current of nutritious sap that sets back into the tree. This is the one product of the factory—the source of all the tree's growth—for it is the elaborated sap, the food which nourishes every living cell from leaf to root tip. It builds new wood layers, extends both twigs and roots, and perfects the buds for the coming year.

Sunset puts a stop to starch making. The power is turned off till another day. The distribution of starch

goes on. The surplus is unloaded, and the way is cleared for work next day. On a sunless day less starch is made than on a bright one.

Excess of water and of free oxygen is noticeable in this making of starch. Both escape in invisible gaseous form through the stomates. No carbon escapes, for it is all used up, and a continual supply of CO^2 sets in from outside. We find it at last in the form of solid wood fibres. So it is the leaf's high calling to take the crude elements brought to it, and convert them into food ready for assimilation.

There are little elastic curtains on the doors of leaves, and in dry weather they are closely drawn. This is to prevent the free escape of water, which might debilitate the starch-making cells. In a moist atmosphere the doors stand wide open. Evaporation does not draw water so hard in such weather, and there is no danger of excessive loss. "The average oak tree in its five active months evaporates about 28,000 gallons of water"—an average of about 187 gallons a day.

In the making of starch there is oxygen left over—just the amount there is left of the carbon dioxide when the carbon is seized for starch making. This accumulating gas passes into the air as free oxygen, "purifying" it for the use of all animal life, even as the absorption of carbon dioxide does.

When daylight is gone, the exchange of these two gases ceases. There is no excess of oxygen nor demand for carbon dioxide until business begins in the morning. But now a process is detected that the day's activities had obscured.

The living tree breathes—inhales oxygen and exhales carbonic-acid gas. Because the leaves exercise the func-

tion of respiration, they may properly be called the lungs of trees, for the respiration of animals differs in no essential from that of plants.

The bulk of the work of the leaves is accomplished before midsummer. They are damaged by whipping in the wind, by the ravages of fungi and insects of many kinds. Soot and dust clog the stomates. Mineral deposits cumber the working cells. Finally they become sere and russet or "die like the dolphin," passing in all the splendor of sunset skies to oblivion on the leaf mould under the trees.

The Growth of a Tree

The great chestnut tree on the hillside has cast its burden of ripe nuts, flung down the empty burs, and given its yellow leaves to the autumn winds. Now the owner has cut down its twin, which was too near a neighbor for the well-being of either, and is converting it into lumber. The lopped limbs have gone to the woodpile, and the boards will be dressed and polished and used for the woodwork of the new house. Here is our opportunity to see what the bark of the living tree conceals—to study the anatomy of the tree—to learn something of grain and wood rings and knots.

The most amazing fact is that this "too, too solid flesh" of the tree body was all made of dirty water and carbonic-acid gas. Well may we feel a kind of awe and reverence for the leaves and the cambium—the builders of this wooden structure we call a tree. The bark, or outer garment, covers the tree completely, from tip of farthest root to tip of highest twig. Under the bark is the slimy, colorless living layer, the *cambium*, which we may define as

the separation between wood and bark. It seems to have no perceptible diameter, though it impregnates with its substance the wood and bark next to it. This cambium is a continuous undergarment, lining the bark everywhere, covering the wood of every root and every twig as well as of the trunk and all its larger divisions.

Under the cambium is the wood, which forms the real body of the tree. It is a hard and fibrous substance, which in cross section of root or trunk or limb or twig is seen to be in fine, but distinctly marked, concentric rings about a central pith. This pith is most conspicuous in the twigs.

Now, what does the chestnut tree accomplish in a single growing season? We have seen its buds open in early spring and watched the leafy shoots unfold Many of these bore clusters of blossoms in midsummer, long yellow spikes, shaking out a mist of pollen, and falling away at length, while the inconspicuous green flowers developed into spiny, velvet-lined burs that gave up in their own good time the nuts which are the seeds of the tree.

The new shoots, having formed buds in the angles of their leaves, rest from their labors. The tree had added to the height and breadth of its crown the exact measure of its new shoots. There has been no lengthening of limb or trunk. But underground the roots have made a season's growth by extending their tips. These fresh rootlets clothed with the velvety root hairs are new, just as the shoots are new that bear the leaves on the ends of the branches.

There is a general popular impression that trees grow in height by the gradual lengthening of trunk and limbs. If this were true, nails driven into the trunk in a vertical line would gradually become farther apart. They do not, as

observation proves. Fence wires stapled to growing trees are not spread apart nor carried upward, though the trees may serve as posts for years, and the growth in diameter may swallow up staple and wire in a short time. Normal wood fibres are inert and do not lengthen. Only the season's rootlets and leafy shoots are soft and alive and capable of lengthening by cell division.

The work of the leaves has already been described. The return current, bearing starch in soluble form, flows freely among the cells of the cambium. Oxygen is there also. The cambium cell in the growing season fulfils its life mission by absorbing food and dividing. This is growth—and the power to grow comes only to the cell attacked by oxygen. The rebuilding of its tissues multiplies the substance of the cambium at a rapid rate. A cell divides, producing two "daughter cells." Each is soon as large as its parent, and ready to divide in the same way. A cambium cell is a microscopic object, but in a tree there are millions upon millions of them. Consider how large an area of cambium a large tree has. It is exactly equivalent to the total area of its bark. Two cells by dividing make four. The next division produces eight, then sixteen, thirty-two, sixty-four, in geometric proportion. The cell's power and disposition to divide seems limited only by the food and oxygen supply. The cambium layer itself remains a very narrow zone of the newest, most active cells. The margins of the cambium are crowded with cells whose walls are thickened and whose protoplasm is no longer active. The accumulation of these worn-out cells forms the total of the season's growth, the annual ring of wood on one side of the cambium and the annual layer of bark on the other.

What was once a delicate cell now becomes a hollow wood fibre, thin walled, but becoming thickened as it gets older. For a few years the superannuated cell is a part of the sap wood and is used as a tube in the system through which the crude sap mounts to the leaves. Later it may be stored full of starch, and the sap will flow up through newer tubes. At last the walls of the old cell harden and darken with mineral deposits. Many annual rings lie between it and the cambium. It has become a part of the heart wood of the tree.

The cells of its own generation that were crowded in the other direction made part of an annual layer of bark. As new layers formed beneath them, and the bark stretched and cracked, they lost their moisture by contact with the outer air. Finally they became thin, loose fibres, and scaled off.

The years of a tree's life are recorded with fair accuracy in the rings of its wood. The bark tells the same story, but the record is lost by its habit of sloughing off the outer layers. Occasionally a tree makes two layers of wood in a single season, but this is exceptional. Sometimes, as in a year of drought, the wood ring is so small as to be hardly distinguishable.

Each annual ring in the chestnut stump is distinct from its neighboring ring. The wood gradually merges from a dark band full of large pores to one paler in color and of denser texture. It is very distinct in oak and ash. The coarser belt was formed first. The spring wood, being so open, discolors by the accumulation of dust when exposed to the air. The closer summer wood is paler in color and harder, the pores almost invisible to the unaided eye. The best timber has the highest percentage of summer wood.

If a tree had no limbs, and merely laid on each year a layer of wood made of parallel fibres fitted on each other like pencils in a box, wood splitting would be child's play and carpenters would have less care to look after their tools. But woods differ in structure, and all fall short of the woodworker's ideal. The fibres of oak vary in shape and size. They taper and overlap their ends, making the wood less easily split than soft pine, for instance, whose fibres are regular cylinders, which lie parallel, and meet end to end without "breaking joints."

Fibres of oak are also bound together by flattened bundles of horizontal fibres that extend from pith to cambium, insinuated between the vertical fibres. These are seen on a cross-section of a log as narrow, radiating lines starting from the pith and cutting straight through heart wood and sap wood to the bark. A tangential section of a log (the surface exposed by the removal of a slab on any side) shows these "pith rays," or "medullary rays" as long, tapering streaks. A longitudinal section made from bark to centre, as when a log is "quarter-sawed," shows a full side view of the "medullary rays." They are often an inch wide or more in oak; these wavy, irregular, gleaming fibre bands are known in the furniture trade as the "mirrors" of oak. They take a beautiful polish, and are highly esteemed in cabinet work. The best white oak has 20 per cent. to 25 per cent. of its substance made up of these pith rays. The horny texture of its wood, together with its strength and durability, give white oak an enviable place among timber trees, while the beauty of its pith rays ranks it high among ornamental woods.

The grain of wood is its texture. Wide annual rings with large pores mark coarse-grained woods. They need

"filling" with varnish or other substance before they can be satisfactorily polished. Fine-grained woods, if hard, polish best. Trees of slow growth usually have fine-grained wood, though the rule is not universal.

Ordinarily wood fibres are parallel with their pith. They are straight grained. Exceptions to this rule are constantly encountered. The chief cause of variation is the fact that tree trunks branch. Limbs have their origin in the pith of the stems that bear them. Any stem is normally one year older than the branch it bears. So the base of any branch is a cone quite buried in the parent stem. A cross-section of this cone in a board sawed from the trunk is a *knot*. Its size and number of rings indicate its age. If the knot is diseased and loose, it will fall out, leaving a *knot hole*. The fibres of the wood of a branch are extensions of those just below it on the main stem. They spread out so as to meet around the twig and continue in parallel lines to its extremity. The fibres contiguous to those which were diverted from the main stem to clothe the branch must spread so as to meet above the branch, else the parent stem would be bare in this quarter. The union of stem and branch is weak above, as is shown by the clean break made above a twig when it is torn off, and the stubborn tearing of the fibres below down into the older stem. A half hour spent at the woodpile or among the trees with a jack-knife will demonstrate the laws by which the straight grain of wood is diverted by the insertion of limbs. The careful picking up and tearing back of the fibres of bark and wood will answer all our questions. Basswood whose fibres are tough is excellent for illustration.

When a twig breaks off, the bark heals the wound and the grain becomes straight over the place. Trees crowded

in a forest early divest themselves of their lower branches. These die for lack of sun and air, and the trunk covers their stubs with layers of straight-grained wood. Such timbers are the masts of ships, telegraph poles, and the best bridge timbers. Yet buried in their heart wood are the roots of every twig, great or small, that started out to grow when the tree was young. These knots are mostly small and sound, so they do not detract from the value of the lumber. It is a pleasure to work upon such a "stick of timber."

A tree that grows in the open is clothed to the ground with branches, and its grain is found to be warped by hundreds of knots when it reaches the sawmill. Such a tree is an ornament to the landscape, but it makes inferior, unreliable lumber. The carpenter and the wood chopper despise it, for it ruins tools and tempers.

Besides the natural diversion of straight grain by knots, there are some abnormal forms to notice. Wood sometimes shows wavy grain under its bark. Certain trees twist in growing, so as to throw the grain into spiral lines. Cypresses and gum trees often exhibit in old stumps a veering of the grain to the left for a few years, then suddenly to the right, producing a "cross grain" that defies attempts to split it.

"Bird's-eye" and "curly maple" are prizes for the furniture maker. Occasionally a tree of swamp or sugar maple keeps alive the crowded twigs of its sapling for years, and forms adventitious buds as well. These dwarfed shoots persist, never getting ahead further than a few inches outside the bark. Each is the centre of a wood swelling on the tree body. The annual layers preserve all the inequalities. Dots surrounded by wavy rings are

scattered over the boards when the tree is sawed. This is bird's-eye grain, beautiful in pattern and in sheen and coloring when polished. It is cut thin for veneer work. Extreme irregularity of grain adds to the value of woods, if they are capable of a high polish. The fine texture and coloring, combined with the beautiful patterns they display, give woods a place in the decorative arts that can be taken by no other material.

The Fall of the Leaves

It is November, and the glory of the woods is departed. Dull browns and purples show where oaks still hold their leaves. Beech trees in sheltered places are still dressed in pale yellow. The elfin flowers of the witch hazel shine like threads of gold against the dull leaves that still cling. The trees lapse into their winter sleep.

Last week a strange thing happened. The wind tore the red robes from our swamp maples and sassafras and scattered them in tatters over the lawn. But the horse-chestnut, decked out in yellow and green, lost scarcely a leaf. Three days later, in the hush of early morning, when there was not a whiff of a breeze perceptible, the signal, "Let go!" came, and with one accord the leaves of the horse-chestnut fell. In an hour the tree stood knee deep in a stack of yellow leaves; the few that still clung had considerable traces of green in them. Gradually these are dropping, and the shining buds remain as a pledge that the summer story just ended will be told again next year.

Perhaps such a sight is more impressive if one realizes the vast importance of the work the leaves of a summer accomplish for the tree before their surrender.

The shedding of leaves is a habit broad-leaved trees have

learned by experience in contact with cold winters. The swamp magnolia is a beautiful evergreen tree in Florida. In Virginia the leaves shrivel, but they cling throughout the season. In New Jersey and north as far as Gloucester, where the tree occurs sparingly, it is frankly deciduous. Certain oaks in the Northern states have a stubborn way of clinging to their dead leaves all winter. Farther south some of these species grow and their leaves do not die in fall, but are practically evergreen, lasting till next year's shoots push them off. The same gradual change in habit is seen as a species is followed up a mountain side.

The horse-chestnut will serve as a type of deciduous trees. Its leaves are large, and they write out, as if in capital letters, the story of the fall of the leaf. It is a serial, whose chapters run from July until November. The tree anticipates the coming of winter. Its buds are well formed by midsummer. Even then signs of preparation for the leaf fall appear. A line around the base of the leaf stem indicates where the break will be. Corky cells form on each side of this joint, replacing tissues which in the growing season can be parted only by breaking or tearing them forcibly. A clean-cut zone of separation weakens the hold of the leaf upon its twig, and when the moment arrives the lightest breath of wind—even the weight of the withered leaf itself—causes the natural separation. And the leaflets simultaneously fall away from their common petiole.

There are more important things happening in leaves in late summer than the formation of corky cells. The plump green blades are full of valuable substance that the tree can ill afford to spare. In fact, a leaf is a layer of the precious cambium spread out on a framework of veins and covered

with a delicate, transparent skin—a sort of etherealized bark. What a vast quantity of leaf pulp is in the foliage of a large tree!

As summer wanes, and the upward tide of sap begins to fail, starch making in the leaf laboratories declines proportionately. Usually before midsummer the fresh green is dimmed. Dust and heat and insect injuries impair the leaf's capacity for work. The thrifty tree undertakes to withdraw the leaf pulp before winter comes.

But how?

It is not a simple process nor is it fully understood. The tubes that carried the products of the laboratory away are bound up with the fibres of the leaf's skeleton. Through the transparent leaf wall the migration of the pulp may be watched. It leaves the margins and the net veins, and settles around the ribs and mid vein, exactly as we should expect. Dried and shrivelled horse-chestnut leaves are still able to show various stages in this marvellous retreat of the cambium. If moisture fails, the leaf bears some of its green substance with it to the earth. The "breaking down of the chlorophyll" is a chemical change that attends the ripening of a leaf. (Leaf ripening is as natural as the ripening of fruit.) The waxy granules disintegrate, and a yellow liquid shows its colors through the delicate leaf walls. Now other pigments, some curtained from view by the chlorophyll, others the products of decomposition, show themselves. Iron and other minerals the sap brought from the soil contribute reds and yellows and purples to the color scheme. As drainage proceeds, with the chemical changes that accompany it, the pageant of autumn colors passes over the woodlands. No weed or grass stem but joins in the carnival of the year.

Crisp and dry the leaves fall. Among the crystals and granules that remain in their empty chambers there is little but waste that the tree can well afford to be rid of—substances that have clogged the leaf and impeded its work.

We have been mistaken in attributing the gay colors of autumnal foliage to the action of frost. The ripening of the leaves occurs in the season of warm days and frosty nights, but it does not follow that the two phenomena belong together as cause and effect. Frost no doubt hastens the process. But the chemical changes that attend the migration of the carbohydrates and albuminous materials from the leaf back into twig and trunk and root for safe keeping go on no matter what the weather.

In countries having a moist atmosphere autumn colors are less vivid. England and our own Pacific Coast have nothing to compare with the glory of the foliage in the forests of Canada and the Northeastern states, and with those on the wooded slopes of the Swiss Alps, and along the Rhine and the Danube. Long, dry autumns produce the finest succession of colors. The most brilliant reds and yellows often appear long before the first frost. Cold rains of long duration wash the colors out of the landscape, sometimes spoiling everything before October. A sharp freeze before the leaves expect it often cuts them off before they are ripe. They stiffen and fall, and are wet and limp next day, as if they had been scalded; all their rich cell substance lost to the tree, except as they form a mulch about its roots. But no tree can afford so expensive a fertilizer, and happily they are not often caught unawares.

Under the trees the dead leaves lie, forming with the snow a protective blanket for the roots. In spring the rains will leach out their mineral substance and add it to

the soil. The abundant lime in dead leaves is active in the formation of *humus*, which is decayed vegetable matter. We call it "leaf mould." So even the waste portions have their effectual work to do for the tree's good.

The leaves of certain trees in regions of mild winters persist until they are pushed off by the swelling buds in spring. Others cling a year longer, in sorry contrast with the new foliage. We may believe that this is an indolent habit induced by climatic conditions.

Leaves of evergreens cling from three to five years. Families and individuals differ; altitude and latitude produce variations. An evergreen in winter is a dull-looking object, if we could compare it with its summer foliage. Its chlorophyll granules withdraw from the surface of the leaf. They seek the lower ends of the palisade cells, as far as they can get from the leaf surface, assume a dull reddish brown or brownish yellow color, huddle in clumps, their water content greatly reduced, and thus hibernate, much as the cells of the cambium are doing under the bark. In this condition, alternate freezing and thawing seem to do no harm, and the leaves are ready in spring to resume the starch-making function if they are still young. Naturally, the oldest leaves are least capable of this work, and least is expected of them. Gradually they die and drop as new ones come on. As among broad-leaved trees, the zone of foliage in evergreens is an outer dome of newest shoots; the framework of large limbs is practically destitute of leaves.

How Trees Spend the Winter

Nine out of every ten intelligent people will see nothing of interest in a row of bare trees. They casually state that buds are made in the early spring. They miss seeing the

strength and beauty of tree architecture which the foliage conceals in summertime. The close-knit, alive-looking bark of a living tree they do not distinguish from the dull, loose-hung garment worn by the dead tree in the row. All trees look alike to them in winter.

Yet there is so much to see if only one will take time to look. Even the most heedless are struck at times with the mystery of the winter trance of the trees. They know that each spring reënacts the vernal miracle. Thoughtful people have put questions to these sphinx-like trees. Secrets the bark and bud scales hide have been revealed to those who have patiently and importunately inquired. A keen pair of eyes used upon a single elm in the dooryard for a whole year will surprise and inform the observer. It will be indeed the year of miracle.

A tree has no centre of life, no vital organs corresponding to those of animals. It is made up, from twig to root, of annual, concentric layers of wood around a central pith.

It is completely covered with a close garment of bark, also made of annual layers. Between bark and wood is the delicate undergarment of living tissue called *cambium*. This is disappointing when one comes to look for it, for all there is of it is a colorless, slimy substance that moistens the youngest layers of wood and bark, and forms the layer of separation between them. This cambium is the life of the tree. A hollow trunk seems scarcely a disability. The loss of limbs a tree can survive and start afresh. But girdle its trunk, exposing a ring of the cambium to the air, and the tree dies. The vital connection of leaves and roots is destroyed by the girdling; nothing can save the tree's life. Girdle a limb or a twig and all above the injury suffers practical amputation.

The bark protects the cambium, and the cambium is the tissue which by cell multiplication in the growing season produces the yearly additions of wood and bark. Buds are growing points set along the twigs. They produce leafy shoots, as a rule. Some are specialized to produce flowers and subsequently fruits. Leaves are extensions of cambium spread in the sun and air in the season when there is no danger from frosts. The leaves have been called the stomachs of a tree. They receive crude materials from the soil and the air and transmute them into starch under the action of sunlight. This elaborated sap supplies the hungry cambium cells during the growing season, and the excess of starch made in the leaf laboratories is stored away in empty wood cells and in every available space from bud to root tip, from bark to pith.

The tree's period of greatest activity is the early summer. It is the time of growth and of preparation for the coming winter and for the spring that follows it. Winter is the time of rest—of sleep, or hibernation. A bear digs a hollow under the tree's roots and sleeps in it all winter, waking in the spring. In many ways the tree imitates the bear. Dangerous as are analogies between plants and animals, it is literally true that the sleeping bear and the dormant tree have each ceased to feed. The sole activity of each seems to be the quiet breathing.

Do trees really breathe? As truly and as incessantly as you do, but not as actively. Other processes are intermittent, but breathing must go on, day and night, winter and summer, as long as life lasts. Breathing is low in winter. The tree is not growing. There is only the necessity of keeping it alive.

Leaves are the lungs of plants. In the growing season

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A GROVE OF BEECHES

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THE CHESTNUT

respiration goes on at a vigorous rate. The leaves also throw off in insensible vapor a vast quantity of water. This is called *transpiration* in plants; in animals the term used is *perspiration*. They are one and the same process. An average white oak tree throws off 150 gallons of water in a single summer day. With the cutting off of the water supply at the roots in late fall, transpiration is also cut off.

The skin is the efficient "third lung" of animals. The closing of its pores causes immediate suffocation. The bark of trees carries on the work of respiration in the absence of the leaves. Bark is porous, even where it is thickest.

Look at the twigs of half a dozen kinds of trees, and find the little raised dots on the smooth surface. They usually vary in color from the bark. These are *lenticels*, or breathing pores—not holes, likely to become clogged with dust, but porous, corky tissue that filters the air as it comes in. In most trees the smooth epidermis of twigs is shed as the bark thickens and breaks into furrows. This obscures, though it does not obliterate, the air passages. Cherry and birch trees retain the silky epidermal bark on limbs, and in patches, at least, on the trunks of old trees. Here the lenticels are seen as parallel, horizontal slits, open sometimes, but usually filled with the characteristic corky substance. They admit air to the cambium.

There is a popular fallacy that trees have no buds until spring. Some trees have very small buds. But there is no tree in our winter woods that will not freely show its buds to any one who wishes to see them. A very important part of the summer work of a tree is the forming of buds for next spring. Even when the leaves are just unfolding

on the tender shoots a bud will be found in each angle between leaf and stem. All summer long its bud is the especial charge of each particular leaf. If accident destroy the leaf, the bud dies of neglect. When midsummer comes the bud is full grown, or nearly so, and the fall of the leaf is anticipated. The thrifty tree withdraws as much as possible of the rich green leaf pulp, and stores it in the twig to feed the opening buds in spring.

What is there inside the wrappings of a winter bud? "A leaf," is the usual reply—and it is not a true one. A bud is an embryo shoot—one would better say, a shoot in miniature. It has very little length or diameter when the scales are stripped off. But with care the leaves can be spread open, and their shape and venation seen. The exact number the shoot was to bear are there to be counted. Take a horse-chestnut bud—one of the biggest ones—and you will unpack a cluster of flowers distinct in number and in parts. The bud of the tulip tree is smaller, but it holds a single blossom, and petals, stamens, and pistil are easily recognizable. Some buds contain flowers and no leaves. Some have shoots with both upon them. If we know the tree, we may guess accurately about its buds.

There is another popular notion, very pretty and sentimental, but untrue, that study of buds is bound to overthrow. It is the belief that the woolly and silky linings of bud scales, and the scales themselves, and the wax that seals up many buds are all for the purpose of keeping the bud warm through the cold winter. The bark, according to the same notion, is to keep the tree warm. This idea is equally untenable. There is but feeble analogy between a warm-blooded animal wrapped in fur, its bodily heat kept up by fires within (the rapid oxidation of fats

and carbohydrates in the tissues), and the winter condition of a tree. Hardy plants are of all things the most cold blooded. They are defended against injuries from cold in an effective but entirely different way.

Exposure to the air and consequent loss of its moisture by evaporation is the death of the cambium—that which lies under the thick bark and in the tender tissues of the bud, sealed up in its layers of protecting scales.

The cells of the cambium are plump little masses of protoplasm, semi-fluid in consistency in the growing season. They have plenty of room for expansion and division. Freezing would rupture their walls, and this would mean disintegration and death. Nature prepares the cells to be frozen without any harm. The water of the protoplasm is withdrawn by osmosis into the spaces between the cells. The mucilaginous substance left behind is loosely enclosed by the crumpled cell wall. Thus we see that a tree has about as much water in it in winter as in summer. Green wood cut in winter burns slowly and oozes water at the ends in the same discouraging way as it does in summertime.

A tree takes on in winter the temperature of the surrounding air. In cold weather the water in buds and trunk and cambium freezes solid. Ice crystals form in the intercellular spaces where they have ample room, and so they do no damage in their alternate freezing and thawing. The protoplasm stiffens in excessive cold, but when the thermometer rises, life stirs again. Motion, breathing, and feeding are essential to cell life.

It is hard to believe that buds freeze solid. But cut one open in a freezing cold room, and before you breathe upon it take a good look with a magnifier, and you should make

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out the ice crystals. The bark is actually frozen upon a stick of green stove wood. The sap that oozes out of the pith and heart wood was frozen, and dripped not at all until it was brought indoors.

What is meant by the freezing of fruit buds in winter, by which the peach crop is so often lost in Northern states? When spring opens, the warmth of the air wakes the sleeping buds. It thaws the ice in the intercellular spaces, and the cells are quick to absorb the water they gave up when winter approached. The thawing of the ground surrounds the roots with moisture. Sap rises and flows into the utmost twig. Warm days in January or February are able to deceive the tree to this extent. The sudden change back to winter again catches them. The plump cells are ruptured and killed by the "frost bite."

It is a bad plan to plant a tender kind of tree on the south side of a house or a wall. The direct and the reflected warmth of the sun forces its buds out too soon, and the late frosts cut them off. There is rarely a good yield on a tree so situated.

There is no miracle like "the burst of spring." Who has watched a tree by the window as its twigs began to shine in early March, and the buds to swell and show edges of green as their scales lengthened? Then the little shoot struggled out, casting off the hindering scales with the scandalous ingratitude characteristic of infancy. Feeble and very appealing are the limp baby leaves on the shoot, as tender and pale green as asparagus tips. But all that store of rich nutritive material is backing the enterprise. The palms are lifted into the air; they broaden and take on the texture of the perfect, mature leaf. Scarcely a day is required to outgrow the hesitation and inexperience of

youth. The tree stands decked in its canopy of leaves, every one of which is ready and eager to assume the responsibilities it faces. The season of starch making has opened.

Cut some twigs of convenient trees in winter. Let them be good ones, with vigorous buds, and have them at least two feet long. You may test this statement I have made about the storing of food in the twigs, and the one about the unfolding of the leafy shoots. Get a number of them from the orchard—samples from cherry, plum, and apple trees; from maple and elm and any other familiar tree. Put them in jars of water and set them where they get the sun on a convenient window shelf. Give them plenty of water, and do not crowd them. It is not necessary to change the water, but cutting the ends slanting and under water every few days insures the unimpeded flow of the water up the stems and the more rapid development of the buds you are watching. When spring comes there are too many things that demand attention. The forcing of winter buds while yet it is winter is the ideal way to discover the trees' most precious secrets.

PART II

THE NUT TREES

THE WALNUTS—THE HICKORIES—THE BEECH—THE CHESTNUTS—THE OAKS—THE WHITE OAK GROUP—THE BLACK OAK GROUP—THE HORSE-CHESTNUTS, OR BUCKEYES—THE LINDENS, OR BASSWOODS

THE WALNUTS

Hickories are included with their near relatives, the walnuts, in one of the most important of all our native tree groups. They are distinct, yet they have many traits in common—the flowers and the nut fruits, the hard resinous wood, with aromatic sap and leaves of many leaflets, instead of a single blade.

The walnuts are decidedly "worth knowing." All produce valuable timber and edible nuts, and all are good shade trees. Four native walnuts are well known in this country, for in October, every tree in every bit of woods is likely to be visited by school boys with bags, eager to gather the nuts before some other boy finds the tree, and thus establishes a prior claim upon it. The curiously gnawed shells outside the winter storehouse of some furry woods-dweller reveal the most successful competitor boys have, the constant watcher of the nut trees, a harvester who works at nothing else while the season is on.

The Southwestern Walnut

Juglans rupestris, Engelm.

The walnut of the Southwest grows into a spreading, luxuriant tree, where its roots find water. But on the canyon sides, and higher on mountain slopes, it becomes a stunted shrub, because of lack of moisture.

The nut is smaller than that of the eastern walnuts and has a thick shell, but the kernel is sweet and keeps its rich flavor for a long time. The Mexicans and Indians are glad to have this nut added to the stores they gather for their winter food.

One striking feature of this tree is the pale, cottony down on its twigs, which sometimes persists three or four years. The long limbs droop at the extremities, almost deserving to be called "weeping." But nothing could be more cheerful in color than the yellow-green foliage, shining in the sun, against the white bark of the tree. In autumn the foliage turns bright yellow. A specimen, much admired, grows in the Arnold Arboretum in Boston.

The California Walnut

J. californica, Wats.

The California walnut is a stocky, round-headed tree, with heavy, drooping branches, and bark that is white and smooth on limbs and on trunks of young trees. Ultimately the trunk turns nearly black, and is checked into broad, irregular ridges. In bottom lands, along the courses of rivers, back thirty miles from the coast, these trees are

found, from the Sacramento Valley to the southern slopes of the San Bernardino Mountains.

The foliage is bright pale green, feathery, the leaflets often curved to sickle form, showing paler silky linings. Californians admire and plant this tree for shade and ornament. Its greatest value is as a hardy stock upon which the "English" walnut is grafted by nurserymen, for planting orchards of this commercial nut. The fruit of the native nut is excellent, but it cannot compete with the thin-shelled nut that came from Persia, *via* England.

The Butternut, White Walnut, or Oilnut

J. cinerea, Linn.

In eastern woods the butternut is known by its long, pointed nuts, with deeply and raggedly sculptured shells, in fuzzy, clammy, sticky husks that stain the hands of him who attempts to get at the oily meat before the husks are dry. This dark stain was an important dye in the time when homespun cotton cloth was worn by men and boys. The modern khaki resembles in color the "butternut jeans," in which backwoods regiments of the Civil War were clad. Butternut husks and bark yield also a drug of cathartic properties.

Pickling green oilnuts in their husks is a housewifely industry, on the summer programme of many housewives still, if the woods near by furnish the raw material for employing her great-grandmother's recipe, brought from England, or perhaps from France. The green nuts are tested with a knitting needle. If it goes through them with no difficulty, and yet the nuts are of good size, they are ready. Vigorous rubbing removes the fuzz after the nuts are

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WEEPING BEECH

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BLACK WALNUT

scalded. Then they are pickled whole, in spiced vinegar, and are a rare, delectable relish with meats for the winter table.

A butternut tree, beside the road, or elsewhere, with room to grow, has a short trunk, and a low, broad head, with a downward droop to the horizontal limbs. The bark is light brown, the limbs grayish green, the twigs and leaves all ooze a clammy, waxy, aromatic sap, and are covered with fine hairs of velvety abundance.

Because it is low and rather wayward in growth, late to leaf out in spring, and early to shed its leaves in summer, the butternut is not a good street tree. It breaks easily in the wind, and crippled trees are more common than well-grown specimens. Insect and fungous enemies beset the species, and take advantage of breaks to invade the twigs through the chambered pith. Short-lived trees they are, whose brown, satiny wood is used in cabinet work, but is not plentiful.

The Black Walnut

J. nigra, Linn.

The black walnut (*see illustrations, pages 31, 70*) is the second species east of the Rocky Mountains, and the tree chiefly depended upon, during the century just closed, by the makers of furniture of the more expensive grades. Black walnut wood is brown, with purplish tones in it, and a silvery lustre, when polished. Its hardness and strength commend it to the boat and ship builder. Gunstock factories use quantities of this wood. In furniture and interior woodwork, the curly walnut, found in the old stumps of trees cut long before, is especially sought for veneering panels. Old furniture, of designs that have passed out,

are often sold to the factories, and their seasoned wood cut thin for veneering.

Walnut trees one hundred and fifty feet high were not uncommon in the forests primeval, in the basin of the Ohio and Wabash rivers. These giants held up their majestic heads far over the tops of oaks and maples in the woods. They were slaughtered, rolled together, and burned by the pioneers, clearing the land for agriculture. These men had a special grudge against walnut trees, they were so stubborn—so hard to make away with. How unfortunate it is that our ancestors had the patience to go forward and conquer the unconquerable ones. Had they weakly surrendered, and let these trees stand, we should have had them for the various uses to which we put the finest lumber trees to-day.

Unhappily, the growing of young trees has not been extensively undertaken to replace those destroyed. The newer forestry is awake to the need, and the loss may be made good, from this time forward.

The black walnut is nearly globular, deeply sculptured, with a sweet nut rich in oil, very good if one eats but a few at a time. Locally, they find their way to market, but they soon become rancid in the grocer's barrel. At home, boys spread them, in their smooth, yellow-pitted husks, on the roof of the woodshed, for instance, so the husks can dry while the nuts are seasoning. No walnut opens its husk in regular segments, as the hickories all do. But the husking is not hard. The thick shells require careful management of the hammer or nut-cracker, to avoid breaking the meats.

Dark as is its wood and bark, no walnut tree in full leaf is sombre. The foliage is bright, lustrous, yellow-green,

graceful, dancing. A majestic tree, with a luxuriant crown from May till September, this walnut needs room to display its notable contour and size. It deserves more popularity than it enjoys as a tree for parks. No tree is more interesting to watch as it grows.

The bitter spongy husk deters the squirrels from gnawing into the nut until the husk is dry and brittle. Hidden in the ground, the shell absorbs moisture, and winter frost cracks it, by the gentle but irresistible force of expanding particles of water as they turn to ice. So the plantlet has no hindrance to its growth when spring opens.

Imitating nature, the nurseryman lays his walnuts and butternuts in a bed of sand or gravel, one layer above another, and lets the rain and the cold do the rest. In spring the "stratified" nuts are ready for planting. Sometimes careful cracking of the shell prepares the nut to sprout when planted.

The Japanese walnuts (*J. Sieboldiana* and *J. cordiformis*) are grown to a limited extent in states where the English walnut is not hardy. They are butternuts, and very much superior to our native species. A Manchurian walnut has been successfully introduced, but few people but the pioneers in nut culture know anything about these exotic species. South America and the West Indies have native species. So we shall not be surprised, in our travels, to find walnuts in the woods of many continents.

The English Walnut

J. regia, Linn.

Originally at home in the forests of Persia and northwestern India, the English walnut was grown for its ex-

cellent nuts in the warm countries of Europe and Asia. It was a tree of great reputation when Linnaeus gave it the specific name that means *royal.* Indeed, this is the tree which gave to all the family the name "*Juglans,*" which means, "Jove's acorn," in the writings of Roman authors. Kings made each other presents of these nuts, and so the range of the species was extended, even to England, by the planting of nuts from the south.

It became the fad of gardeners, before the fifteenth century, to improve the varieties, and to compete with others in getting the thinnest shell, the largest nut, the sweetest kernel, just as horticulturists do now. In 1640 the herbalist Parkinson wrote about a variety of "French wallnuts, which are the greatest of any, within whose shell are often put a paire of fine gloves, neatly foulded up together." Another variety he mentions "whose shell is so tender that it may easily be broken between one's fingers, and the nut itsself is very sweete."

In England, the climate prevents the ripening of the fruit of walnut trees. But the nuts reach good size, and are pickled green, for use as a relish; or made into catsups—husks and all being used, when a needle will still puncture the fruit with ease.

In America, the first importations of the walnuts came from the Mediterranean countries, by way of England, "the mother country." In contradistinction to our black walnuts and butternuts, these nuts from overseas were called by the loyal colonists "English walnuts," and so they remain to this day in the markets of this country.

It was natural and easy to grow these trees in the Southern states. But little had been done to improve them, or

to grow them extensively for market, until California undertook to compete with Europe for the growing American trade. Now the crop reaches thousands of tons of nuts, and millions of dollars come back each year to the owners of walnut ranches. Hardy varieties have extended the range of nut-orcharding; and so has the grafting of tender varieties on stock of the native black walnut of California.

The beauty of this Eurasian walnut tree would justify planting it merely for the adornment of parks and private grounds. Its broad dome of bright green foliage in summer, and its clean gray trunk and bare branches in winter, are attractive features in a landscape that has few deciduous trees. A fine dooryard tree that bears delicious nuts, after furnishing a grateful shade all summer, is deserving the popularity it enjoys with small farmers and owners of the simplest California homes.

As a lumber tree, the walnut of Europe has long been commercially important. It is the staple wood for gunstocks, and during wars the price has reached absurd heights, one country bidding against its rival to get control of the visible supply. Furniture makers use quantities of the curly walnut often found in stumps of old trees. The heart wood, always a rich brown, is often watered and crimped in curious and intricate patterns, that when polished blend the loveliest dark and light shades with the characteristic walnut lustre, to reward the skilled craftsman.

In the United States this wood is rarely seen, because the trees are grown for their nuts. They require several years to come into bearing, are long-lived, have few enemies, and need little pruning as bearing age approaches.

THE HICKORIES

Americans have a right to be proud that the twelve hickory species are all natives of this country. Eleven of the twelve are found in the eastern half of the United States; one, only, strays into the forests of Mexico. No other country has a native hickory.

Indians of the Algonkin tribe named this tree family, and taught the early colonists in Virginia to use for food the ripe nuts of the shagbark and mockernut. After cracking the shells, the procedure was to boil and strain the mixture, which gave them a rich, soupy liquid. Into this they stirred a coarse meal, made by grinding between stones the Indian corn. The mush was cooked slowly, then made into cakes, which were baked on hot stones. No more delicious nor wholesome food can be imagined than this. Frequently the soup was eaten alone; its name, "Powcohicora," gave the trees their English name, part of which the botanist, Raffinesque, took, Latinized, and set up as the name of the genus.

Cut a twig of any hickory tree, and you realize that the wood is close-grained and very springy. The pith is solid, with a star form in cross-section, corresponding to the ranking of the leaves on the twigs. The wind strews no branches under a hickory tree, for the fibres of the wood are strong and flexible enough to resist a hurricane. (*See illustrations, pages 6, 71.*)

Hickory wood is unequalled for implements which must resist great strain and constant jarring. The running-gear of wagons and carriages, handles of pitchforks, axes, and like implements require it. Thin strips, woven into bask-

ets for heavy market use, are almost indestructible. No fuel is better than seasoned hickory wood.

Shagbark or Shellbark

~~Hicoria~~ ovata, Britt.

The shagbark has gray bark that is shed in thin, tough, vertical strips. Attached by the middle, these strips often spring outward, at top and bottom, giving the bole a most untidy look (*see illustrations, pages, 6, 71*), and threatening the trousers of any boy bold enough to try climbing into the smooth-barked top to beat off the nuts.

In spite of the ragged-looking trunk, a shagbark grown in the open is a noble tree. The limbs are angular, but they express strength to the utmost twig, as the bare oblong of the tree's lofty head is etched against a wintry sky.

The nuts are the chief blessing this tree confers upon the youngsters of any neighborhood. Individual trees differ in the size and quality of their fruit. The children know the best trees, and so do the squirrels, their chief competitors at harvest time.

Frost causes the eager lads to seek their favorite trees, and underneath they find the four-parted husks dropping away from the angled nuts. There is no waiting, as with walnuts, for husking time to come. The tree is prompt about dropping its fruit. Spread for a few weeks, where they can dry, and thieving squirrels will let them alone, hickory nuts reach perfect condition for eating. Fat, proteid, and carbohydrates are found in concentrated form in those delicious meats. We may not know their dietetic value, but we all remember how good and how satisfying they are. No tree brings to the human family more val-

uable offerings than this one, rugged and ragged though it be.

The Big Shellbark

H. lacinata, Sarg.

The big shellbark, like the little shellbark, is a common forest tree in the Middle West and Middle Atlantic states. It has a shaggy trunk, stout limbs, picturesquely angular, and it bears nuts that are sweet and of delicious flavor. In winter the orange-colored twigs, large terminal buds, and persistent stems of the dead leaves are distinguishing traits. These petioles shed the five to nine long leaflets and then stay on, their enlarged bases firmly tied by fibre bundles to the scar, though the stems writhe and curve as if eager to be free to die among the fallen blades.

"King nuts," as the fruit of this tree is labelled in the markets, do not equal the little hickory nuts in quality, and their thick shells cover meats very little larger. But the nut in its husk on the tree is often three inches long—a very impressive sight to hungry nut-gatherers.

In summer the downy leaf-linings and the uncommon size of the leaves best distinguish this tree from its near relative, whose five leaflets are smooth throughout, small, very rarely counting seven.

The Pecan

H. Pecan, Britt.

The pecan tree bears the best nuts in the hickory family. This species is coming to be a profitable orchard tree in many sections of the South. Most of the pecan nuts in the

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WHITE OAK

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BUR, OR MOSSY-CUP, OAK — LEAVES AND FRUIT

market come from wild trees in the Mississippi Basin. But late years have seen great strides taken to establish pecan growing as a paying horticultural enterprise in states outside, as well as within, the tree's natural range. And these efforts are succeeding.

Experiment stations have tested seedling trees and selected varieties of known merit, until they know by actual experiment that pecans can be raised successfully in the Carolinas and in other states where the native species does not grow wild. Thin-shelled varieties, with the astringent red shell-lining almost eliminated, have been bred by selection, and propagated by building on native stock. The trees have proved to be fast-growing, early-fruiting, and easy to grow and protect from enemies.

The market pays the highest price for pecans. The popularity of this nut is deserved, because by analysis it has the highest food value combined with the most delicate and delicious flavor. No nut is so rich in nutriment. None has so low a percentage of waste. The demand for nuts is constantly increasing as the public learns that the proteid the body needs can be obtained from nuts as well as from meat.

Pecans have suffered in competition with other nuts because they are difficult to get out of the shells without breaking the meats. The old-fashioned hammer and block is not the method for them. A cracker I saw in use on the street corner in Chicago delighted me. Clamped to the nut-vendor's stall, it received the nut between two steel cups and, by the turn of a wheel, crowded it so that the shell buckled and broke where it is thinnest, around the middle, and the meat came out whole.

The Mockernut

H. alba, Britt.

The mockernut is a mockery to him who hopes for nuts like those of either shagbark. The husk is often three inches long. Inside is a good-sized nut, angled above the middle, suggesting the shagbark. But what a thick, obstinate shell, when one attempts to "break and enter!" And what a trifling, insipid meat one finds, to repay the effort! Quite often there is nothing but a spongy remnant or the shell is empty. (*See illustration, page 7.*)

As a shade tree, the mockernut has real value, showing in winter a tall, slender pyramidal form, with large terminal buds tipping the velvety, resinous twigs. The bark is smooth as that of an ash, with shallow, wavy furrows, as if surfaced with a silky layer of new healing tissue, thrown up to fill up all depressions. Mockernut leaves are large, downy, yellow-green, turning to gold in autumn. Crushed they give out an aroma suggesting a delicate perfume.

The flowers are abundant, and yet the most surprising show of colors on this tree comes in late April, when the great buds swell. The outer scales fall, and the inner ones expand into ruddy silken sheathes that stand erect around the central cluster of leaves, not yet awake, and every branch seems to hold up a great red tulip! The sight is wonderful. Nothing looks more flower-like than these opening hickory buds, and to the unobserving passerby the transformation is nothing short of a miracle. In a day, the leaves rise and spread their delicate leaflets, lengthening and becoming smooth, as the now useless red scales fall in a shower to the ground.

The Pignut

H. glabra, Britt.

The pignut deserves the better name, "smooth hickory," a more ingratiating introduction to strangers. A graceful, symmetrical tree, with spreading limbs that end in delicate, pendulous branches, and gray bark checked into a maze of intersecting furrows, it is an ornament to any park, even in the dead of winter. In summer the tree laughs in the face of the sun, its smooth, glossy, yellow-green leaflets, five to seven on a stem, lined with pale green or yellow. In spring the clustered fringes among the opening leaves are the green and gold stamen flowers. The curiously angled fertile flowers, at the tips of twigs, are green, with yellow stigmas. Autumn turns the foliage to orange and brown, and lets fall the pear-shaped or rounded fruit, each nut obscurely four-angled and held fast at the base by the thin, 4-ridged husk, that splits scarcely to the middle. The kernel is insipid, sometimes bitter, occasionally rather sweet. Country boys scorn the pignut trees, leaving their fruit for eager but unsophisticated nut-gatherers from the towns.

Pigs used to be turned into the woods to fatten on beech- and oak-"mast." They eagerly devoured the thin-shelled nuts of *H. glabra*, and thus the tree earned the friendly regard of farmers, and a name that preserves an interesting bit of pioneer history.

The range of the pignut is from Maine to Florida on the Atlantic seaboard, west to the middle of Nebraska and Texas, and from Ontario and Michigan south to the Gulf.

THE BEECH

The American Beech

Fagus Americanus, Sweet.

One of the most widely distributed trees in our country, this is also one of the most useful and most beautiful in any forest. It is the sole representative of its genus in the Western Hemisphere. One species is a valuable timber tree in Europe. Three are natives of Asia. A genus near of kin includes the beech trees of the Southern Hemisphere, twelve species in all. There is closer resemblance, however, between our beeches and their next of kin, the chestnuts and oaks.

From the Great Lakes to the Gulf of Mexico, from Florida to Texas, from New England to Wisconsin, beech trees grow; and where they grow they are very likely to form "pure forests," on the slopes of mountains and rich river bottoms. The largest specimens grow in the basin of the lower Ohio River, and on the warm slopes of the Alleghany Mountains.

Standing alone, with room for full development, the beech is a fine, symmetrical tree, with horizontal or slightly drooping branches, numerous, thickly set with slender, flexible twigs. The stout trunk supports a round or conical head of very dense foliage. One hundred and twenty feet is the maximum height, with a trunk diameter of three to four feet. (*See illustrations, pages 22, 30.*)

The older the trees, the greater the amount of red heart wood in proportion to the white sap-wood, next to the bark. Red and white beech wood are distinguished by lumbermen. Red beech makes superior floors, tool-

handles, chairs, and the like, and there is no more perfect fuel than seasoned beech wood.

It is unreasonable to think that any but the blind could live where beech trees grow and not know these trees at a glance. The bark is close, unfurrowed, gray, often almost white, and marked with blotches, often nearly round of paler hue.

The branches are dark and smooth and the twigs polished to the long, pointed winter buds. Throughout, the tree is a model of elegant attire, both in color and texture of the investing bark.

In the growing season the leaves are the tree's chief attraction. They are closely plaited, and covered with silvery down, when the bud scales are pushed off in the spring. In a day, the protective fuzz disappears, and the full-grown leaf is seen, thin, strongly feather-veined, uniformly green, saw-toothed. Summer shows the foliage mass almost as fresh, and autumn turns its green to pale gold. Still unblemished, it clings, often until the end of winter, lighting the woods with a ghostly glow, as the rain fades the color out. The silky texture is never quite lost.

The delicate flowers of the beech tree are rarely seen, they fade so soon; the stamen tassels drop off and the forming nuts, with their prickly burs, are more and more in evidence in the leaf angles near the ends of new shoots. With the first frost the burs open, the four walls part, releasing the two nuts, three-angled, like a grain of buckwheat.

The name of this grain was suggested by its resemblance in form to the beechnut, or "buck mast," sweet, nutritious food of so many dwellers in the forest. Buck mast was the food of man when he lived in caves and under the forest cover. We know that beechnuts have a rich, delicate flavor that offsets the disadvantages of their small size

and the difficulty of opening their thin but leathery shells. All along the centuries European peoples have counted on this nut, and oil expressed from it, for their own food and the dried leaves for forage for their cattle in winter.

The American pioneer turned his hogs into the beech woods to fatten on the beech-mast, and Thanksgiving turkeys were always finer if they competed with the wild turkey on the same fare.

Birds and lesser mammals do much to plant trees when they carry away, for immediate or future use, seeds that are not winged for flight. Beechnuts are light enough to profit, to some extent, by a high wind. And beech trees in their infancy do well under the shade of other trees. So each fruiting tree is the mother of many young ones. But the seedling trees are not so numerous and important as the sapling growth that rises from the roots of parent trees. By these alone, a few isolated beeches will manage to take possession of the ground around them and to clothe it with so dense a foliage screen that all young growth, except certain ferns and grasses, dies for lack of sun. Before we can realize what is going on, the tract is a pure forest of beech, rapidly enlarging on all sides by the same campaign of extension.

THE CHESTNUTS

Chestnut and Chinquapin

Castanea dentata, Borh., and *C. pumila*, Mill.

Our native chestnut and its little brother, the chinquapin, are the American cousins of the sweet chestnut of

southern Europe. Japan has contributed to American horticulture a native species which bears large but not very sweet nuts, that are good when cooked. Our two trees bear sweet nuts, of a flavor that no mode of cooking improves. In truth, there is no finer nut; and the time to enjoy it to the highest degree is a few weeks after the frost opens the burs and lets the nuts fall. "Along about Thanksgiving," they have lost some of their moisture and are prime.

In foreign countries the chestnut is a rich, nourishing food, comparable to the potato. Who could go into ecstasies over a vegetable that is a staple food for the peasants of Europe, Asia, and North Africa? Our chestnut is no staple. It is a delicacy. It is treasure trove from the autumn woods, and the gathering of the crop is a game in which boys and squirrels are rivals.

Ernest Thompson Seton, always a boy, knows the impatience with which the opening of the burs is watched for, as the belated frosts keep off, and the burs hang tantalizingly closed. The cruel wounds made by the spines and the raw taste of the immature nuts are poor recompense for the labor of nutting before Nature gives the sign that all's ready.

Here is Mr. Seton's estimate of the chestnut of "brown October's woods."

"Whenever you see something kept under lock and key, bars and bolts, guarded and double-guarded, you may be sure it is very precious, greatly coveted. The nut of this tree is hung high aloft, wrapped in a silk wrapper, which is enclosed in a case of sole leather, which again is packed in a mass of shock-absorbing, vermin-proof pulp, sealed up in a waterproof, iron-wood case, and finally cased in a vege-

table porcupine of spines, almost impregnable. There is no nut so protected; there is no nut in our woods to compare with it as food."

What a disaster then is the newly arisen bark disease that has already killed every chestnut tree throughout large areas in the Eastern states. Scientists have thus far struggled with it in vain and it is probable that all chestnuts east of the Rockies are doomed.

Chinquapins grow to be medium-sized trees in Texas and Arkansas, but east of the Mississippi they are smaller, and east of the Alleghanies, mere shrubby undergrowth, covering rocky banks or crouching along swamp borders. They are smaller throughout, but resemble the chestnut in leaf, flowers, and fruit. The bur contains a single nut.

The chestnut tree grows large and attains great age, its sturdy, rough gray trunk crowned with an oblong head of irregular branches, hidden in summer by the abundant foliage mass. (*See illustration, page 23.*) The ugly cripple that lightning has maimed covers its wounds when May wakes the late-opening buds and the leaves attain full size.

Each leaf tapers at both ends, its length three or four times its width. Strong-ribbed and sharp-toothed, and wavy on the midrib, dark, polished, like leather, these units form a wonderful dome, lightened in midsummer by the pencil-like plumes of the staminate flowers, with the fertile ones at their bases. As autumn comes on the leaf crown turns to gold, and the mature fruits are still green spiny balls. The first frost and the time to drop the nuts are dates that every schoolboy knows come close together.

When a chestnut tree falls by the axe, the roots restore

the loss by sending up sprouts around the stump. The mouldering pile nourishes a circle of young trees, full of vigor, because they have the large tree's roots gathering food for them. No wonder their growth is rapid.

Besides this mode of reproduction, chestnut trees, growing here and there throughout a mixed forest, are the offspring of trees whose nuts were put away, or dropped and lost by squirrels. When spring relieves the danger of famine, many of the rodent class abandon their winter stores before they are all devoured. Such caches add many nut trees to our native woods.

THE OAKS

This is the great family of the cup-bearers, whose fruit, the acorn, is borne in a scaly cup that never breaks into quarters, as does the husk that holds a chestnut, beechnut, or hickory nut. All oak trees bear acorns as soon as they come to fruiting age. This is the sign by which they are known the world over. Seldom is a full-grown oak without its little insignia, for the cups cling after the nut falls, and one grand division of the family requires two seasons to mature its fruit. For this reason, half-grown acorns are seen on the twigs after the ripe ones fall.

We cannot say of oak trees that they all have sturdy trunks, rough bark, and gnarled limbs, for not all of them have these characteristics. But there is a certain likeness in oak leaves. They are simple, five-ranked, generally oval, and the margins are generally cut into lobes by deep or shallow bays. Most oak leaves have leathery texture, strong veins, and short petioles. They are leaves that out-

last the summer, and sometimes persist until spring growth unseats the stalks; sometimes, as in the "live oaks," they hang on three to five years.

The twigs of oak trees are more or less distinctly five-angled, and the winter buds cluster at the ends. This insures a group of young shoots, crowded with leaves, on the ends of branches, and a dense outer dome of foliage on the tree.

Nearly three hundred distinct species of oaks are recognized by botanists, and the list is growing. New species are in the making. For instance, a white oak and a bur oak grow near enough for the wind to "cross-fertilize" their pistillate flowers. The acorns of such mixed parentage produce trees that differ from both parents, yet reveal characteristics of both. They are "hybrids," and may be called new varieties of either parent. Other species of oak are intercrossing by the same process—the interchange of pollen at the time of blossoming. This proves that the oak family is young, compared with many other families, whose members are too distantly related to intercross.

Though geologically young, the oak family is one of the most important, furnishing timber of superior strength and durability for bridge-building, ship-building, and other construction work. Tanning has depended largely upon oak bark. As fuel, all oak trees are valuable.

Fifty species of oak are native to North American forests. Twice as many grow east of the Rocky Mountains as west of the Great Divide. No species naturally passes this barrier. The temperate zone species extend southward into tropical regions, by keeping to high altitudes. Thus we find American oaks in the Andes and Colombia; Asiatic species occur in the Indian Archi-

pelago. No Old World species is native to America. Each continent has its own.

East of the Rocky Mountains the oaks hold a place of preëminence among broad-leaved trees. They are trees of large size, and they often attain great age. They are beautiful trees, and therefore highly valued for ornamental planting. This has led to the introduction of oaks from other countries. We have set European, Japanese, and Siberian oaks in our finest parks. Europe has borrowed from our woods the red oak and many others. All countries are richer by this horticultural exchange of trees.

Our native oaks fall into two groups: the annual-fruiting and the biennial-fruiting species. The first group matures its acorns in a single season; the second requires two seasons. It happens that annuals have leaves with rounded lobes, while biennials have leaves with lobes that end in angles and bristly tips. The bark of the annual trees is generally pale; that of the biennials, dark. Hence the white oak group and the black oak group may be easily distinguished at a glance, by the bark, the leaf, and the acorn crop.

THE WHITE OAK GROUP

The White Oak

Quercus alba, Linn.

The white oak has no rival for first place in the esteem of tree-lover and lumberman. Its broad, rounded dome, sturdy trunk, and strong arms (*see illustration, page 38*), and its wide-ranging roots enable a solitary tree to resist

storms that destroy or maim other kinds. Strength and tenacity in the fibre of root and branch make it possible for individuals to live to a great age, far beyond the two centuries required to bring it to maturity. Such trees stir within us a feeling of reverence and patriotism. They are patriarchs whose struggles typify the pioneer's indomitable resistance to forces that destroyed all but the strong.

White oak trees in the forest grow tall, lose their lower branches early, and lift but a small head to the sun. The logs, quarter-sawed, reveal the broad, gleaming "mirrors" that make a white oak table beautiful. The botanist calls these the *medullary rays*—thin, irregular plates of tissue-building cells, that extend out from the central pith, sometimes quite to the sap-wood, crowding between the wood fibres, which in the heart-wood are no longer alive. A slab will show only an edge of these mirrors. But any section from bark to pith will reveal them.

The pale brown wood of the white oak distinctly shows the narrow rings of annual growth. Each season begins with a coarse, porous band of "*spring wood*," followed by a narrower band of fine, close-grained "*summer wood*." White oak is streaked with irregular, dark lines. These are the porous lines of spring wood, discolored by foreign matter. Count them, allow a year for each, and you know how long one white oak tree required to make an inch of wood.

The supreme moment in the white oak's year comes in spring, when the gray old tree wakes, the buds swell and cast off their brown scales, and the young leaves appear. The tree is veiled, not with a garment of green, but with a mist of rose and silver, each twig hung with soft limp velvety leaves, red-lined, and covered with a close mat of

silky hairs. It is a spectacle that seems unreal, because it is so lovely and gone so soon. The protecting hairs and pigments disappear, and the green leafage takes its place, brightened by the yellow tassels of the stamen flowers, and the growing season is on.

In autumn the pale-lined leaves of the white oak turn slowly to sombre violet and dull purplish tones. Clinging there, after the acorns have all fallen and been gathered by squirrels, the foliage fades into the gray of the bark and may persist until spring growth sets in.

The Bur Oak

Q. macrocarpa, Michx.

The bur oak (*see illustration, page 39*) is called the mossy-cup on account of the loose, fringed scales about the rim of the cup that holds the large acorn—largest in the whole oak family. Often the nut is completely enclosed by the cup; often it is small. This variable fruit is sweet, and it is the winter store of many furry wood-folk.

The leaf has the rounded lobing of the family, with the special peculiarity of being almost cut in two by a pair of deep and wide opposite sinuses, between the broad middle, and the narrow, tapering base. Not all leaves show this odd form, but it is the prevailing pattern. The dark green blade has a pale, fuzzy lining, that lasts until the leaves turn brown and yellow.

The bur oak is a rugged, ragged tree, compared with the white oak. Its irregular form is picturesque, its wayward limbs are clothed in a loose garment of untidy, half-shed bark. The twigs are roughened with broad, corky wings.

The trunk is brownish, with loosened flakes of gray, separated by shallow fissures.

The wood is classed with white oak, though darker in color. It has the same ornamental mirrors, dear to the heart of the cabinet-maker. It serves all the purposes for which a tough, strong, durable wood is needed.

The range of the species is from Nova Scotia to Montana, and it grows in large tracts from Winnipeg to Texas, doing well in the arid soil of western Nebraska and Dakota. Suckers from the roots spread these trees till they form the "oak openings" of the bluffs of the Missouri and other streams of Iowa and Minnesota. In Kansas it is the commonest oak tree. The largest trees of this species grow in rich bottom lands in the Ohio Valley.

The Post Oak

Q. minor, Sarg.

The post oak has wood that is noted for its durability when placed in contact with the soil. It is in demand for fence posts, railroad ties, and for casks and boat timbers. "Iron oak" is a name that refers to the qualities of the wood. "Knees" of post oak used to be especially in demand.

In the Mississippi Basin this tree attains its largest size and greatest abundance on gravelly uplands. It is the commonest oak of central Texas, on the sandy plains and limestone hills. Farther north, it is more rare and smaller, becoming an undersized oak in New York and westward to Kansas.

In winter the post oak keeps its cloak of harsh-feeling, thick, coarse-veined leaves. Tough fibres fasten them to

the twigs. In summer the foliage mass is almost black, with gray leaf-linings. The lobes and sinuses are large and squarish, the blades four or five inches long. The limbs, tortuous, horizontal, form a dense head.

The Chestnut Oak

Q. Prinus, Linn.

The chestnut oak has many nicknames and all are descriptive. Its leaves are similar in outline and size to those of the chestnut. The margin is coarsely toothed, not lobed, like the typical oak leaf. "Tanbark oak" refers to the rich store of tannin in the bark, which makes this species the victim of the bark-peeler for the tanneries wherever it grows. "Rock chestnut oak" is a title that lumbermen have given to the oak with exceptionally hard wood, heavy and durable in soil, adapted for railroad ties, posts, and the like.

Unlike other white oaks, the bark of this tree is dark in color and deeply fissured. Without a look at the leaves, one might call it a black oak.

The centre of distribution for this species seems to be the foothill country of the Appalachian Mountains, in Tennessee and North Carolina. Here it predominates, and grows to its largest size. From Maine to Georgia it chooses rocky, dry uplands, grows vigorously and rapidly, and its acorns often sprout before falling from the cup!

The chestnut oak is one of the most desirable kinds of trees to plant in parks. It is symmetrical, with handsome bark and foliage. The leaves turn yellow and keep their fine texture through the season. The acorn is one of the

handsomest and largest, and squirrels are delighted with its sweet kernel.

The Mississippi Valley Chestnut Oak

Q. acuminata, Sarg.

In the Mississippi Valley the chestnut oak is *Q. acuminata*, Sarg., with a more slender and more finely-toothed leaf that bears a very close resemblance to that of the chestnut. The foliage mass is brilliant, yellow-green, each leaf with a pale lining, and hung on a flexible stem. "Yellow oak" is another name, earned again when in autumn the leaves turn to orange shades mingled with red.

On the Wabash River banks these trees surpass one hundred feet in height and three feet in diameter. The base of the trunk is often buttressed. Back from the rich bottom lands, on limestone and flinty ridges, where water is scarce, these trees are stunted. In parks they are handsome, and very desirable. The bark is silvery white, tinged with brown, and rarely exceeds one half an inch in thickness.

The Swamp White Oak

Q. platanoides, Sudw.

The swamp white oak loves to stand in wet ground, sometimes even in actual swamps. Its small branches shed their bark like the buttonwood, the flakes curling back and showing the bright green under layer. On the trunk the bark is thick, and broken irregularly into broad, flat ridges coated with close, gray-brown scales often tinged with red.

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HORSE-CHESTNUT IN BLOSSOM

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WEEPING WILLOW

In its youth the swamp white oak is comely and symmetrical, its untidy moulting habit concealed by the abundant foliage. One botanist calls this species *bicolor*, because the polished yellow-green upper surfaces contrast so pleasantly with the white scurf that lines each leaf throughout the summer. Yellow is the autumn color. Never a hint of red warms this oak of the swamps, even when planted as a street or park tree in well-drained ground.

The Basket Oak

Q. Michauxii, Nutt.

The basket oak is so like the preceding species as to be listed by some botanists as the southern form of *Q. platanoides*. They meet on a vague line that crosses Maryland, Kentucky, and Tennessee. Both have large leaves silver-lined, with undulating border, of the chestnut oak pattern. Both are trees of the waterside, tall, with round heads of gnarled limbs. The red-tinged white bark sets the basket oak apart from all others. Its head is broader and its trunk stouter than in the other species. The paired acorns are almost without stalks, the nuts large, the kernels sweet. In autumn, farmers turn their hogs into the woods to fatten on this oak-mast. The edibility of these nuts may account for the common name, "cow oak."

The wood splits readily into thin, tough plates of the summer wood. This is because the layer formed in spring is very porous. Bushel baskets, china crates, and similar woven wares are made of these oak splints. The wood is also used in cooperage and implement construction, and it makes excellent firewood.

The Live Oak

Q. Virginiana, Mill.

The live oak with its small oval leaves, without a cleft in the plain margins, looks like anything but an oak to the Northerner who walks along a street planted with this evergreen in Richmond or New Orleans. It is not especially good for street use, though often chosen. It develops a broad, rounded dome, by the lengthening of the irregular limbs in a horizontal direction. The trunk becomes massive and buttressed to support the burden.

The "knees" of this oak were in keenest demand for ship-building before steel took the place of wood. In all lines of construction, this lumber ranks with the best white oak. The short trunk is the disadvantage, from the lumberman's viewpoint. Its beauty, when polished, would make it the wood *par excellence* for elegant furniture, except that it is difficult to work, and it splits easily.

The Spanish moss that drapes the limbs of live oaks in the South gives them a greenish pallor and an unkempt appearance that seems more interesting than beautiful to many observers. It is only when the sight is familiar, I think, that it is pleasing. Northern trees are so clean-limbed and so regular about shedding their leaves when they fade, that these patient hosts, loaded down with the pendent skeins of the tillandsia, seem to be imposed upon. In fact, the "moss" is not a parasite, sapping the life of the tree, but a lodger, that finds its own food supply without help.

California White Oak

Q. lobata, Née.

The California white oak far exceeds the Eastern white oak in the spread of its mighty arms. The dome is often two hundred feet in breadth and the trunk reaches ten feet in diameter. Such specimens are often low in proportion, the trunk breaking into its grand divisions within twenty feet of the ground. The ultimate spray is made of slender, supple twigs, on which the many-lobed leaves taper to the short stalks. Dark green above, the blades are lined with pale pubescence. The acorns are slender, pointed, and often exceed two inches in length. Their cups are comparatively shallow, and they fall out when ripe.

The bare framework of one of these giant oaks shows a wonderful maze of gnarled branches, whose grotesque angularities are multiplied with added years and complicated by damage and repair.

It is hard to say whether the grace and nobility of the verdure-clad tree, or the tortuous branching system revealed in winter, appeals more strongly to the admiration of the stranger and the pride of the native Californian, who delights in this noble oak at all seasons. Its comparatively worthless wood has spared the trees to adorn the park-like landscapes of the wide middle valleys of the state.

Pacific Post Oak

Q. Garryana, Hook.

The Pacific post oak is the only oak in British Columbia, whence it follows down the valleys of the Coast Range to

the Santa Cruz Mountains. It is a tree nearly one hundred feet high, with a broad, compact head, in western Washington and Oregon. Dark green, lustrous leaves, with paler linings, attain almost a leathery texture when full grown. They are four to six inches long and coarsely lobed. In autumn they sometimes turn bright scarlet.

The wood is hard, strong, tough, and close-grained. It is employed in the manufacture of wagons and furniture, and in ship-building and cooperage. It is a superior fuel.

THE BLACK OAK GROUP

A large group of our native oaks require two seasons to mature their acorns; have dark-colored bark and foliage, have leaves whose lobes are sharp-angled and taper to bristly points and tough acorn shells lined with a silky-hairy coat.

The Black Oak

Q. velutina, Lam.

The black oak of the vast region east of the Rocky Mountains is the type or pattern species. Its leathery, dark green leaves are divided by curving sinuses into squarish lobes, each ending in one or more bristly tips. The lobes are paired, and each has a strong vein from the midrib. Underneath, the leaf is always scurfy, even when the ripening turns its color from bronze to brown, yellow or dull red.

Under the deep-furrowed, brown surface bark is a yellow layer, rich in tannin, and a dyestuff called *quercitron.* This makes the tree valuable for its bark. The wood is coarse-

grained, hard, difficult to work, and chiefly employed as fuel.

A distinguishing trait of the bare tree is the large fuzzy winter bud. The unfolding leaves in spring are bright red above, with a silvery lining.

The autumn acorn crop may be heavy or light. Trees have their "off years," for various reasons. But always, as leaves and fruit fall and bare the twigs, one sees, among the winter buds, the half-grown acorns waiting for their second season of growth.

The pointed nut soon loosens, for the cup though deep has straight sides. The kernel is yellow and bitter.

The Scarlet Oak

Q. coccinea, Moench.

The scarlet oak is like a flaming torch set among the dull browns and yellows in our autumnal woods. In spring the opening leaves are red; so are the tasselled catkins and the forked pistils, that turn into the acorns later on. This is a favorite ornamental tree in Europe and our own country. Its points of beauty are not all in its colors.

The tree is slender, delicate in branch, twig, and leaf—quite out of the sturdy, picturesque class in which most oaks belong. The leaf is thin, silky smooth, its lobes separated by sinuses so deep that it is a mere skeleton compared with the black oak's. The trimness of the leaf is matched by the neat acorn, whose scaly cup has none of the looseness seen in the burly black oak. The scales are smooth, tight-fitting, and they curl in at the rim.

There is lightness and grace in a scarlet oak, for its twigs are slim and supple as a willow's, and the leaves flutter on

long, flexible stems. Above the drifts of the first snowfall, the brilliance of the scarlet foliage makes a picture long to be remembered against the blue of a clear autumnal sky.

The largest trees of this species grow in the fertile uplands in the Ohio Valley. But the most brilliant hues are seen in trees of smaller size, that grow in New England woods. In the comparatively dull-hued autumn woods of Iowa and Nebraska the scarlet oak is the most vivid and most admired tree.

The Pin Oak

Q. palustris, Linn.

The pin oak earns its name by the sharp, short, spur-like twigs that cluster on the branches, crowding each other to death and then persisting to give the tree a bristly appearance. The tree in winter bears small resemblance to other oaks. The trunk is slender, the shaft carried up to the top, as straight as a pine's. The branches are very numerous and regular, striking out at right angles from the stem, the lower tier shorter than those directly above them, and drooping often to the ground.

On the winter twigs, among the characteristic "pins," are the half-grown acorns that proclaim the tree an oak beyond a doubt, and a *black* oak, requiring a second summer for the maturing of its fruit. It is likely that there will be found on older twigs a few of the full-grown acorns, or perhaps only the trim, shallow saucers from which the shiny, striped, brown acorns have fallen. Hunt among the dead leaves and these little acorns will be discovered for, though pretty to look at, they are bitter and squirrels leave them where they fall.

The leaves match the slender twigs in delicacy of pattern. Thin, deeply cut, shining, with pale linings, they flutter on slender stems, smaller but often matching the leaves of the scarlet oak in pattern. Sometimes they are more like the red oak in outline. In autumn they turn red and are a glory in the woods.

One trait has made this tree a favorite for shade and ornament. It has a shock of fibrous roots, and for this reason is easily transplanted. It grows rapidly in any moist, rich soil. It keeps its leaves clean and beautiful throughout the season. Washington, D. C., has its streets planted to native trees, one species lining the sides of a single street or avenue for miles. The pin oaks are superb on the thoroughfare that reaches from the Capitol to the Navy Yard. They retain the beauty of their youth because each tree has been given a chance to grow to its best estate. In spring the opening leaves and pistillate flowers are red, giving the silvery green tree-top a warm flush that cheers the passerby. In European countries this oak is a prime favorite for public and private parks.

The Red Oak

Q. rubra, Linn.

The red oak grows rapidly, like the pin oak, and is a great favorite in parks overseas, where it takes on the rich autumnal red shades that give it its name at home. Such color is unknown in native woods in England.

The head of this oak is usually narrow and rounded; the branches, short and stout, are inclined to go their own way, giving the tree more of picturesqueness than of symmetry, as age advances. Sometimes the dome is

broad and rounded like that of a white oak, and in the woods, where competition is keen, the trunk may reach one hundred and fifty feet in height.

The red oak leaf is large, smooth, rather thin, its oval broken by triangular sinuses and forward-aiming lobes, that end in bristly points. The blade is broadest between the apex and the middle, where the two largest lobes are. No oak has leaves more variable than this.

Under the dark brown, close-knit bark of a full-grown red oak tree is a reddish layer that shows in the furrows. The twigs and leaf-stems are red. A flush of pink covers the opening leaves, and they are lined with white down which is soon shed.

The bloom is very abundant and conspicuous, the fringe-like pollen-bearing aments four or five inches long, drooping from the twigs in clusters, when the leaves are half-grown in May.

The acorns of the red oak are large, and set in shallow saucers, with incurving rims. Few creatures taste their bitter white kernels.

The Willow Oak

Q. Phellos, Linn.

The willow oak has long, narrow, pointed leaves that suggest a willow, and not at all an oak. The supple twigs, too, are willow-like, and the tree is a lover of the waterside. But there is the acorn, seated in a shallow, scaly cup, like a pin oak's. There is no denying the tree's family connections.

A southern tree, deservedly popular in cities for shade and ornamental planting, it is nevertheless hardy in

Philadelphia and New York; and a good little specimen seems to thrive in Boston, in the Arnold Arboretum. As a lumber tree, the species is unimportant.

The Shingle, or Laurel, Oak

Q. imbricaria, Michx.

The shingle or laurel oak may be met in any woodland from Pennsylvania to Nebraska, and south to Georgia and Arkansas. It may be large or small; a well-grown specimen reaches sixty feet, with a broad, pyramidal, open head.

The chief beauty of the tree, at any season, is the foliage mass—dark, lustrous, pale lined, the margin usually unbroken by any indentations. In autumn the yellow, channelled midribs turn red, and all the blades to purplish crimson, and this color stays a long time. It is a wonderful sight to see the evening sunlight streaming through the loose, open head of a laurel oak. No wonder people plant it for shade and for the beauty it adds to home grounds and public parks.

The Mountain Live Oak

Q. chrysolepis, Liebm.

The mountain live oak cannot be seen without climbing the western slopes of the mountains from Oregon to Lower California, and eastward into New Mexico and Arizona. On levels where avalanches deposit detritus from the higher slopes, sufficient fertility and moisture are found to maintain groves of these oaks, wide-domed, with massive, horizontal branches from short, buttressed trunks—the

Western counterpart of the live oak of the South, but lacking the familiar drapery of pale green moss.

The leaves are leathery, polished, oval blades, one or two inches in length, with unbroken margins, abundant on intricately divided, supple twigs, that droop with their burden and respond to the lightest breeze. The leaves persist until the bronze-green new foliage expands to replace the old, and keep the tree-tops evergreen.

The acorns are large, and their thick, shallow saucers are covered with yellow fuzz. For this character, the tree is called the gold-cup oak. In June, the copious bloom is yellow. Even at an altitude of eight thousand feet the familiar gold-cup acorns are borne on shrubby oaks not more than a foot high!

The maximum height of the species is sixty feet. The wood is the most valuable oak of the West Coast. It is used for wagons and agricultural implements.

The Live Oak

Q. agrifolia, Née.

The live oak (*Q. agrifolia*, Née.) called also "Encina," is the huge-limbed, holly-leaved live oak of the lowlands, that reaches its greatest abundance and maximum stature in the valleys south of San Francisco Bay. The giant oaks of the University campus at Berkeley stretch out ponderous arms, in wayward fashion, that reach far from the stocky trunk and often rest their mighty elbows on the ground. The pointed acorns, usually exceeding an inch in length, are collected by woodpeckers, and tucked away for further reference in holes they make in the bark of the same oaks.

From the mountain slopes to the sea, and from Mendocino County to Lower California, groves of this semi-prostrate giant are found, furnishing abundant supply of fuel, but no lumber of any consequence, because the trunks are so short and the limbs so crooked.

THE HORSE-CHESTNUTS, OR BUCKEYES

The Horse-chestnut

Aesculus Hippocastanum, Linn.

At the head of this family stands a stately tree, native of the mountains of northern Greece and Asia Minor, which was introduced into European parks and planted there as an avenue tree when landscape gardening came into vogue. By way of England it came to America, and in Eastern villages one often sees a giant horse-chestnut, perhaps the sole remnant of the street planting of an earlier day.

Longfellow's "spreading chestnut tree" was a horse-chestnut. And the boys who watched the smith at his work doubtless filled their pockets with the shiny brown nuts and played the game of "conquerors" every autumn as regularly as they flew their kites in spring. What boy has not tied a chestnut to each end of a string, whirled them round and round at a bewildering rate of speed and finally let them fly to catch on telegraph wires, where they dangle for months and bother tidy folks?

The glory of the horse-chestnut comes at blooming time, when the upturning branches, like arms of candelabra, are each tipped with a white blossom-cluster, pointed

like a candle flame. (*See illustration, page 54.*) Each flower of the pyramid has its throat-dashes of yellow and red, and the curving yellow stamens are thrust far out of the dainty ruffled border of the corolla.

Bees and wasps make music in the tree-top, sucking the nectar out of the flowers. Unhappily for us humans, caterpillars of the leopard and tussock moths feed upon the tender tissues of this tree, defacing the foliage and making the whole tree unsightly by their presence.

Sidewalks under horse-chestnut trees are always littered with something the tree is dropping. In early spring the shiny, wax-covered leaf buds cast off and they stick to slate and cement most tenaciously. Scarcely have the folded leaflets spread, tent-like, before some of them, damaged by wind or late frosts or insects' injury, begin to curl and drop, and as the leaves attain full size, they crowd, and this causes continual shedding. In early autumn the leaflets begin to be cast, the seven fingers gradually loosening from the end of the leaf-stalk; then comes a day when all of the foliage mass lets go, and one may wade knee deep under the tree in the dead leaves. The tree is still ugly from clinging leaf-stems and the slow breaking of the prickly husks that enclose the nuts.

With all these faults, the horse-chestnut holds its popularity in the suburbs of great cities, for it lives despite smoke and soot. Bushey Park in London has five rows of these trees on either side of a wide avenue. When they are in bloom the fact is announced in the newspapers and all London turns out to see the sight. Paris uses the tree extensively; nearly twenty thousand of them line her streets, and thrive despite the poverty of the soil.

The American buckeyes are less sturdy in form and less

showy in flower than the European species, but they have the horse-shoe print with the nails in it where the leaf-stalk meets the twig. The brown nuts, with the dull white patch which fastens them in the husk, justifies the name "buckeye." One nibble at the nut will prove to any one that, as a fruit, it is too bitter for even horses. Bitter, astringent bark is characteristic of the family.

The Ohio Buckeye

Ae. glabra, Willd.

The Ohio buckeye has five yellow-green leaflets, smooth when full grown, pale, greenish yellow flowers, not at all conspicuous, and bitter nuts in spiny husks. The whole tree exhales a strong, disagreeable odor. The wood is peculiarly adapted to the making of artificial limbs.

The great abundance of this little tree in the Ohio Valley accounts for Ohio being called the "Buckeye State."

The Sweet Buckeye

Ae. octandra, Marsh.

The sweet buckeye is a handsome, large tree with greenish yellow, tubular flowers and leaves of five slender, elliptical leaflets. Cattle will eat the nuts and paste made from them is preferred by bookbinders; it holds well, and book-loving insects will not attack it. These trees grow on mountain slopes of the Alleghanies from western Pennsylvania southward, and west to Iowa and Texas.

The California Buckeye

Ae. californica, Nutt.

The California buckeye spreads wide branches from a squat trunk, and clothes its sturdy twigs with unmistakable horse-chestnut leaves and pyramids of white flowers. Sometimes these are tinted with rose, and the tree is very beautiful. The brown nuts are irregular in shape and enclosed in somewhat pear-shaped, two-valved husks.

This western buckeye follows the borders of streams from the Sacramento Valley southward; they are largest north of San Francisco Bay, in the canyons of the Coast Range.

Shrubby, red-flowered buckeyes, often seen in gardens and in the shrubbery borders of parks, are horticultural crosses between the European horse-chestnut and a shrubby, red-flowered native buckeye that occurs in the lower Mississippi Valley.

THE LINDENS, OR BASSWOODS

This tropical family, with about thirty-five genera, has a single tree genus, *tilia*, in North America. This genus has eighteen or twenty species, all told, with representatives in all temperate regions of the Northern Hemisphere, with the exception of Central America, Central Asia, and the Himalayas.

Tilia wood is soft, pale-colored, light, of even grain, adaptable for wood-carving, sounding-boards of pianos, woodenwares of all kinds, and for the manufacture of

paper. The inner bark is tough and fibrous. It has been used since the human race was young, in the making of ropes, fish nets, and like necessities. It was a favorite tying material in nurseries and greenhouses until the more adaptable raffia came in to take its place. The bark of young trees is stripped in spring to make the shoes of the Russian peasantry. An infusion of basswood flowers has long been a home remedy for indigestion, nervousness, coughs, and hoarseness. Experiments in Germany have successfully extracted a table oil from the seed-balls. A nutritious paste resembling chocolate has been made from its nuts, which are delicious when fresh. In winter the buds, as well as the tiny nuts, stand between the lost trapper and starvation. The flowers yield large quantities of nectar, and honey made near linden forests is unsurpassed in delicacy of flavor.

About the time of Louis XIV, the French fashion arose of planting avenues to lindens, where horse-chestnuts had formerly been the favorite tree. The fashion spread to England of bordering with "lime trees" approaches to the homes of the gentry. "Pleached alleys" were made with these fast-growing trees that submitted so successfully to severe pruning and training. All sorts of grotesque figures were carved out of the growing lime trees in the days before topiary work in gardens submitted to the rules of landscape art, and slower growing trees were chosen for such purposes.

In cultivation, lindens have the virtues of swift growth, superb framework, clean, smooth bark, and late, profuse, beautiful and fragrant bloom, which is followed by interesting seed clusters, winged with a pale blade that lightens the foliage mass. One fault is the early dropping of the

leaves, which are usually marred by the wind soon after they reach mature size. Propagation is easy from cuttings and from seed.

The American Linden, or Basswood

Tilia Americana, Linn.

The American linden or basswood is a stately spreading tree reaching one hundred and twenty feet in height and a trunk diameter of four feet. The bark is brown, furrowed, and scaly, the branches gray and smooth, the twigs ruddy. The alternate leaves are obliquely heart-shaped, saw-toothed, with prominent veins that branch at the base, only on the side next to the petiole. (*See illustration, page 86.*) Occasionally the leaf blades are eight inches long. A dense shade is cast by a linden tree in midsummer.

The blossoms, cream-white and clustered on pale green, leaf-like blades, open by hundreds in June and July, actually dripping with nectar, and illuminating the platforms of green leaves. A bird flying overhead looks down upon a tree covered with broad leaf blades overlapping like shingles on a roof. It must look underneath to see the flowers that delight us as we look up into the tree-top from our station on the ground.

In midsummer the linden foliage becomes coarse and wind-whipped; the soft leaf-substance is attacked by insects that feed upon it; plant lice deface them with patches of honey-dew, and the sticky surfaces catch dust and soot. Riddled and torn, they drop in desultory fashion, their faded yellow not at all like the satisfying gold of beech and hickory leaves.

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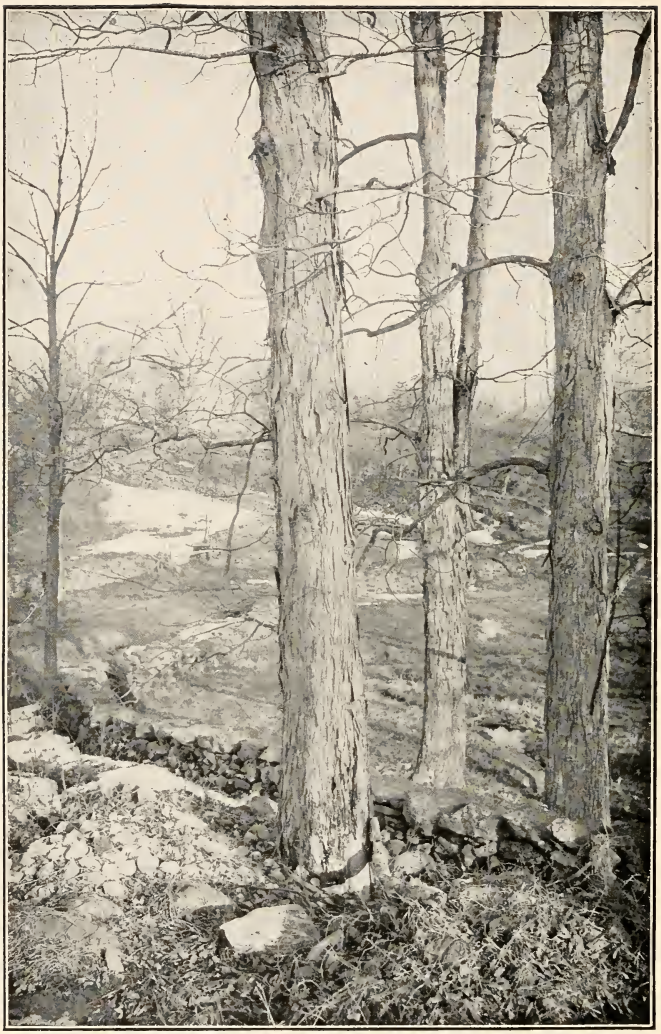
THE BLACK WALNUT

The young shoots are velvety and aromatic. The pistillate flowers, in groups of 3 to 5, are on terminal spikes



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SHAGBARK HICKORY IS KNOWN AND NAMED BY ITS LOOSE, STRIPPING BARK

The flight of basswood seeds on their wing-like blades goes on throughout the winter. This alone would account for the fact that basswoods greatly outnumbered all other trees in the virgin forests of the Ohio Valley. The seeds are not the tree's sole dependence. Suckers grow up about the stump of a tree the lumberman has taken, or the lightning has stricken. Any twig is likely to strike root, and any cutting made from a root as well.

The finest specimen I know grew from a walking-stick cut in the woods and thrust into the ground, by a mere chance, when the rambler reached home. It is the roof tree of a mansion, tall enough to waft its fragrance into the third-story windows, and to reach high above the chimney pots.

The range of this tree extends from New Brunswick to Dakota and south to Virginia and Texas. Its wood is used for carriage bodies, furniture, cooperage, paper pulp, charcoal, and fuel.

The Bee Tree, or White Basswood

T. heterophylla, Vent.

The bee tree or white basswood of the South has narrower leaves than the species just described, and they vary in form and size; but always have linings of fine, silvery down, and the fruits are fuzzy. A wonderful, dazzling play of white, pale green, and deeper shades is seen when one of these trees flutters its leaf mass against a background, sombre with hemlocks and an undergrowth of rhododendron. The favorite haunts of this species are the sides of mountain streams. Wild bees store their hoard of honey in the hollow trunks of old trees; and it is

the favorite holiday of many country folk to locate these natural hives and despoil them. In order to do this the tree must come down, and the revenge of the outraged swarm is sometimes a high price to pay for the stolen sweets.

This linden is found from Ithaca, New York, southward along the Appalachian Mountains to northern Alabama, and westward into Illinois and Tennessee. It is best and most abundant in the mountains of eastern Tennessee and North Carolina, at a considerable altitude.

The Downy Basswood

T. pubescens, Ait.

The downy basswood has leaves that are green on both sides, but its young shoots and leaf-linings are coated with rusty hairs. It is a miniature throughout of the American basswood, except that the blade that bears the flower-cluster is rounded at its base, while the others taper narrowly to the short stem. This species occurs on Long Island, and is sparingly seen along the coast from the Carolinas to Texas.

The Common Lime

T. vulgaris

"Unter den Linden," the famous avenue in Berlin, is planted with the small-leaved common lime of Europe, beside which the American basswood is a coarse-looking tree. Very disappointing docked trees they are, along this thoroughfare; for city streets are never places where a tree can reach its best estate. In the rural sections of France

and Germany this tree reaches noble stature and great age.

Linnaeus, the Swedish botanist, had his name from a fine linden tree, when his peasant father rose to the dignity of a surname. "Linn" is the Swedish word for linden. "Carl Linne," meaning "Charles of the linden tree," it was at first when he played as a boy in the shadow of its great branches. "Carolus Linnaeus" he became when he was appointed professor of the university at Upsala, and through all time since.

Gerarde discourses quaintly upon the linden tree in his "Grete Herball" published in England in 1597. "The male tree," he says, "is to me unknown." We smile at his notion that there are male and female trees in this family, but we wonder at the accuracy of observation evinced by one who lived and wrote before the science of botany had any existence. Evidently Master Gerarde had a good pair of eyes, and he has well expressed the things he saw. I quote a paragraph:

"The female line, or linden tree waxeth very great and thicke, spreading forth its branches wide and fare abroad, being a tree which yieldeth a most pleasant shadow, under and within whose boughs may be made brave summer houses and banqueting arbors, because the more that it is surcharged with weight of timber and such like, the better it doth flourish. The bark is brownish, very smooth and plaine on the outside, but that which is next to the timber is white, moist and tough, serving very well for ropes, trases and halters. The timber is whitish, plaine, and without knots; yea, very soft and gentle in the cutting and handling. The leaves are smooth, greene, shining and large, somewhat snipt or toothed about the edges: the floures are little, whitish, of a good savour, and very many

in number; growing clustered together from out of the middle of the leaf: out of which proceedeth a small whitish long narrow leafe: after the floures succeed cornered sharp pointed nuts, of the bignesse of hasell nuts. This tree seemeth to be a kinde of elme, and the people of Essex (whereas great plenty groweth by the waysides) do call it broad-leafed elme."

PART III

THE WATER-LOVING TREES

The Poplars—The Willows—The Hornbeams—The Birches—The Alders—The Sycamores, or Buttonwoods—The Gum Trees—The Osage Orange

THE POPLARS

The poplars are plebeian trees, but they have a place to fill and they fill it with credit. They are the hardy, rude pioneers that go before and prepare the way for nobler trees. Let a fire sweep a path through the forest, and the poplar is likely to be the first tree to fill the breach. The trees produce abundant seed, very much like that of willows, and the wind sows it far and wide. The young trees love the sun, and serve as nurse trees to more valuable hardwoods and conifers, that must have shade until they become established. By the time the more valuable species are able to take care of themselves, the poplars have come to maturity and disappeared, for they are quick-growing, short-lived trees. The wind plays havoc with their brittle branches. Seldom has a good-sized poplar tree any claim to beauty.

Tenacity of life, if not of fibre, belongs to the poplar tribe. Twigs strike root and the roots send up suckers from underground; cutting off these suckers only en-

courages them to fresh activity. The only way to get rid of the young growth that springs up about an old tree is to use the grubbing-hoe thoroughly and patiently.

Poplar blossoms, borne in catkins, show the close relationship between this genus and the willows. The leaves, however, are always broad and leathery, and set on long stems. Twenty-five species are known, twelve of which are American.

The White Poplar

Populus alba, Linn.

The white poplar is sometimes called the silver-leaved poplar because its dark, glossy leaves are lined with cottony nap. This sprightly contrast of light and shade in the foliage is most unusual, and very attractive in early spring; but the leaf-linings collect soot and dust, and this they carry to the end of the season—a fact which should not be forgotten by those considering the advisability of planting this tree in a city where much soft coal is burned.

The white bark of this European poplar reminds us of the birch family, though it has no silky fringe shedding from the surface. The leaves often imitate the maple in the divisions of their margins, justifying the name "maple-leaved poplar."

As a dooryard tree this species has a wider popularity than it deserves. The wind breaks the brittle branches, and when these accidents threaten its life, the tree sends up suckers which form a grove about the parent trunk, and defy all efforts to eradicate them, until the grubbing-hoe and axe have been resorted to.

The Black Poplar

P. nigra, Linn.

The Lombardy poplar, a variety of the black poplar of Europe, is a familiar tree figure along roadsides, and often marks boundary lines between farms. Each tree is an exclamation point, its branches short and numerous, rising toward the zenith. The roundish leaves that twinkle on these aspiring branches make the tree pretty and interesting when young—just the thing to accent a group of round-headed trees in a park. But not many years are attained before the top becomes choked with the multitude of its branches. The tree cannot shed this dead wood and the beauty of its youth is departed. The trunk grows coarse, warty, and buttressed at the base. Suckers are thrown up from the roots. There is little left to challenge admiration. Since the tree gives practically no shade, we must believe that the first planters were attracted by its odd shape and its readiness to grow, rather than by any belief in its fitness for avenue and highway planting.

The Cottonwood

P. deltoidea, Marsh.

The cottonwood justifies its existence, if ever a tree did. On our Western plains, where the watercourses are sluggish and few and often run dry in midsummer, few trees grow; and the settler and traveler is grateful for the cottonwoods. The pioneer on the Western prairie planted it for shade and for wind-breaks about his first home. Many of these trees attain great age and in protected situations

are magnificent though unsymmetrical trees, shaking out each spring a new head of bright green, glossy foliage, each leaf responsive to the lightest breeze.

"Necklace-bearing poplar," it has been called, from the fact that children find pleasure in stringing for beads the green, half-grown pods containing the minute seeds. They also delight in gathering the long, red caterpillar-like catkins of the staminate flowers, the pollen bearers, from the sterile trees. A fertile tree is sometimes counted a nuisance in a dooryard because its pods set free a great mass of cotton that collects in window screens, to the annoyance of housewives. But this seed time is soon over.

Just these merits of quick growth, prettiness, and tenacity of life, belong to the Carolina Poplar, a variety of native cottonwood that lines the streets of the typical suburban tract opened near any American city. The leaves are large and shine with a varnish which protects them from dust and smoke. But the wind breaks the branches, destroys the symmetry of the tree's head, and in a few years the suburban community takes on a cheap and ugly look. The wise promoter will alternate slow-growing maples and elms with the poplars so that these permanent trees will be ready to take their places in a few years.

The Aspen

P. tremuloides, Michx.

The trembling aspen, or quaking asp, is the prettiest tree of all the poplar tribe. Its bark is gray and smooth, often greenish and nearly white. An aspen copse is one of the loveliest things in the spring landscape. In March the bare, angular limbs show green under their bark, one of the

first prophecies of spring; then the buds cast their brown scales and fuzzy gray catkins are revealed. There are few shades of olive and rose, few textures of silk and velvet that are not duplicated as the catkins lengthen and dance like chenille fringe from every twig. With the flowers, the new leaves open; each blade limp, silky, as it unrolls, more like the finest white flannel than anything else. (*See illustrations, pages 86-87.*) Soon the leaves shed all of this hairy, protective coat, passing through various tones of pink and silver on their way to their lustrous, bright green maturity. Their stems are flattened in a plane at right angles with the blade. Being long and pliant besides, they catch the breeze on blade or stem, and so the foliage is never still on the quietest of summer days. "Popple" leaves twinkle and dance and catch the sunlight like ripples on the surface of a stream, while the foliage of oaks and other trees near by may be practically motionless.

The Balsam Poplar

P. balsamifera, Linn.

The balsam poplar is the balm of Gilead of the early settlers, the Tacamahac of the Northern Indians. They squeezed the fragrant wax from the winter buds and used it to seal up the seams in their birch-bark canoes. The bees taught the Indian the uses of this glutinous secretion, which the tree used to seal the bud-scales and thus keep out water. When growth starts with the stirring of the sap, this wax softens; then the bees collect and store it against a day of need. Whether their homes be hollow trees or patent hives, weather-cracks are carefully sealed up with this waterproof gum, which the bee-keeper knows as "*propolis*."

Forests of balm of Gilead cover much of the vast British possessions north of the United States, and reach to the ultimate islands of the Aleutian group. They dip down into the states as far as Nebraska and Nevada. In cultivation, the species has proved itself a tree of excellent habit, easily propagated and transplanted, and of rapid growth. It has all the good points of the Carolina poplar and lacks its besetting sin of becoming so soon an unsightly cripple.

Narrow-leaved Cottonwood

P. angustifolia, James.

Lance-leaved Cottonwood

P. acuminata, Rydb.

Mexican Cottonwood

P. Mexicana, Wesm.

These three cottonwoods line the banks of mountain streams at high elevations in the great system of mountain chains that stretch from British Columbia southward. The dancing foliage, bright green in summer, golden in autumn, lends a charming color note to the dun stretches of arid plain and the sombre green of pine forests. These trees furnish the settler fuel, shade, and wind-breaks while he is converting his "homestead" into a home.

Black Cottonwood

P. trichocarpa, Hook.

Farther west, covering the mountain slopes from Alaska to Mexico, and liking even better the moist, rich lowlands, is the black cottonwood, the giant of the genus,

reaching two hundred feet in height, and seven to eight feet in trunk diameter. Tall and stately, it lifts its broad rounded crown upon heavy upright limbs. In the Yosemite the dark, rich green of these poplar groves along the Merced River makes a rich, velvet margin, glorious when it turns to gold in autumn.

Swamp Cottonwood

P. heterophylla, Linn.

The swamp cottonwood of the South has leaves of variable but distinctly poplar form, always large, broadly ovate, with slim round petioles. The white down of the unfolding leaves often persists into midsummer. On account of the fluttering leaves the trees were called, by the early Acadians, "*Langues de femmes*" a mild calumny traceable to the herbalist, Gerarde, who compares them to "women's tongues, which seldom cease wagging."

The wood of poplars, soft, weak, and of slight value for fuel or lumber, has within two decades come into a position of great economic importance. Wood pulp is made of it, and out of wood pulp a thousand articles, from toys to wheels of locomotives, are made. A state forester declared: "If I could replace the maples in the state forest by poplars to-day, I would do it gladly. It would be worth thousands of dollars to the state."

THE WILLOWS

Along the watercourses the willow family finds its most congenial habitat. It is a very large family, numbering more than one hundred and seventy species, which are,

however, mostly shrubs rather than trees. America has seventy species of willows, and new forms are constantly being discovered, which are the results of the crossing of closely related species. These "natural hybrids" have greatly confused the botany of the willow family.

Not more than half a dozen American willows ever attain the height of good-sized trees, and many of these are more commonly found in the tangled shrubbery of river banks, or covering long semi-arid strips of ground far to the north, or on mountain sides where their growth is stunted. Little trees, six inches high, bearing the characteristic catkins and narrow leaves of the willow, are found on the arctic tundras.

The wood of willows is pale in color, soft in texture, and of very little use as lumber or fuel, except in localities where trees are scarce. The Indian depended upon the inner bark of the withy willow for material for his fish nets and lines, and farmers in the pioneer days took the tough, supple stems, when spring made the sap run freely, for the binding together of the rails of their fences. Knotted tight and seasoned, these twigs hardened and lasted for years.

In Europe the white willow has long been used for the making of wooden shoes, artificial limbs, and carriage bodies. Its wood makes the finest charcoal for gunpowder. Willow wares, such as baskets and wicker furniture, are as old as civilization, and that in its primitive stages. It is a common sight in Europe to see groves of trees from which the long twigs have been taken yearly for these uses. The stumps are called "pollards" and the trees "pollarded willows" whose discouraging task has been to grow a yearly crop of withes for the basket-makers; yet each spring finds them bristling with the new growth.

The hosts of Cæsar invading England in the First Century found the Britons defending themselves behind willow-woven shields, and living in huts of wattled willows, smeared with mud. From that time to the present the uses of these long shoots have multiplied.

The roots of willows are fibrous and tough as the shoots. For this reason they serve a useful purpose in binding the banks of streams, especially where these are liable to flood. Nature seems to have designed these trees for just this purpose, for a twig lying upon the ground strikes root at every joint if the soil it falls on is sufficiently moist. The wind breaks off twigs and the water carries them down stream where they lodge on banks and sand bars, and these are soon covered with billows of green.

Willows start growth early in spring, putting out their catkins, the two sexes on different trees, before the opening of the leaves. Before the foliage is full grown, the light seeds, each a minute speck, floats away in a wisp of silky down. Its vitality lasts but a day, so it must fall on wet ground at once in order to grow. But the willow family is quite independent of its seeds in the matter of propagation. Chop the roots and twigs into bits and each will grow. Chop a young willow tree into sticks and fence posts and each one, if it is stuck green into the ground, covers itself with a head of leafy twigs before the season is over.

Weeping Willow

Salix Babylonica

The weeping willow, much planted in cemeteries and parks, came originally from Asia and is remarkable for its

narrow leaves that seem fairly to drip from the pendulous twigs. (*See illustration, page 55.*) The foliage has a wonderful lightness and cheerfulness of expression, despite its weeping habit.

The Pussy Willow

S. discolor, Muehl.

The pussy willow is the familiar bog willow, whose gray, silky catkins appear in earliest spring. A walk in the woods in late February often brings us the charming surprise of a meeting with this little tree, just when its gray pussies are pushing out from their brown scales. We cut the twigs and bring them home and watch the wonderful color changes that mark the full development of the flowers. Turning them in the light, one sees under the sheen of silky hairs the varied and evanescent hues that glow in a Hungarian opal. In midsummer a pussy willow tree is lost among the shrubby growth in any woods. It is only because it leads the procession of the spring flowers that every one knows and loves it. (*See illustrations, pages 86-87.*)

THE HORNBEAMS

Two genera of little trees in the same family with the birches are frequently met in the woods, often modestly hiding under the larger trees. One is the solitary representative of its genus: the other has a sister species.

The hornbeams grow very slowly and their wood is close-grained, heavy, and hard. In flexibility, strength, and ability to stand strain, it rivals steel. Before metals so

generally became competitors of woods in construction work, hornbeam was the only wood for rake teeth, levers, mallets, and especially for the beams of ox yokes. It outwore the stoutest oak, the toughest elm. Springiness adapted it for fork handles and the like. Bowls and dishes of hornbeam lasted forever, and would never leak nor crack. "Ironwood" is the name used wherever the wood was worked.

American Hornbeam

Carpinus Carolinianum, Walt.

The American hornbeam has bluish gray bark, very fine in texture, from which the name "blue beech," is common in some localities. "Water beech" points out the tree's preference for rich swamp land.

The trunk and limbs are strangely swollen, sometimes like a fluted column, oftener irregularly, the swelling under the bark suggesting the muscular development of a gymnast's arm.

In favorable places the hornbeams grow into regular oval heads, their branches dividing into a multitude of wiry, supple twigs. Crowded under oaks and other forest growth, they crouch and writhe; and their heads flatten into tangled masses of foliage.

The delicate leaves, strong-ribbed, oval, pointed, turn to red and orange in autumn. (*See illustration, page 87.*) The paired nutlets are provided with a parachute each, so that the wind can sow them broadcast. This wing is leafy in texture, shaped like a maple leaf, and curved into the shape of a boat. After they have broken apart, the nutlets hang by threads, tough as hornbeam fibres always are.

At last, away they sail, to start new trees if they fall in moist soil.

The European hornbeam was a favorite tree for making the "pleached alleys," of which old-world garden-lovers were proud. A row of trees on each side of a promenade were pruned and trained to cover an arching framework, and to interlace their supple branches so that at length no other framework was needed, and one walked through a tunnel of green so closely interlaced as to make walls and roof that shut out light and wind and rain! Hedges, fences, and many fancies of the gardener were worked out with this hornbeam, so willingly did it lend itself to cutting and moulding into curious forms.

Hop Hornbeam

Ostrya Virginiana, Willd.

The hop hornbeam has habits like the other ironwood and an equal reputation for the hardness of its wood. The tree, however, wears scaly, shaggy brown bark, suggesting in its manner of scaling off the shagbark hickory. Its nutlets are packed separate in loose papery bags, and together form a loose, cone-like cluster, like the fruit of a hop vine. The wind scatters these buoyant little bags, that travel far.

This tree often twists in growing, and the trunk shows spiral furrows. "Hard-tack," "beetle-wood," "lever-wood"—all take us back to the pioneer who put this wood to such good uses, and who was glad to have these little trees growing in his woodlot. In hickories, even, he had not the equal of them for strength and hardness.

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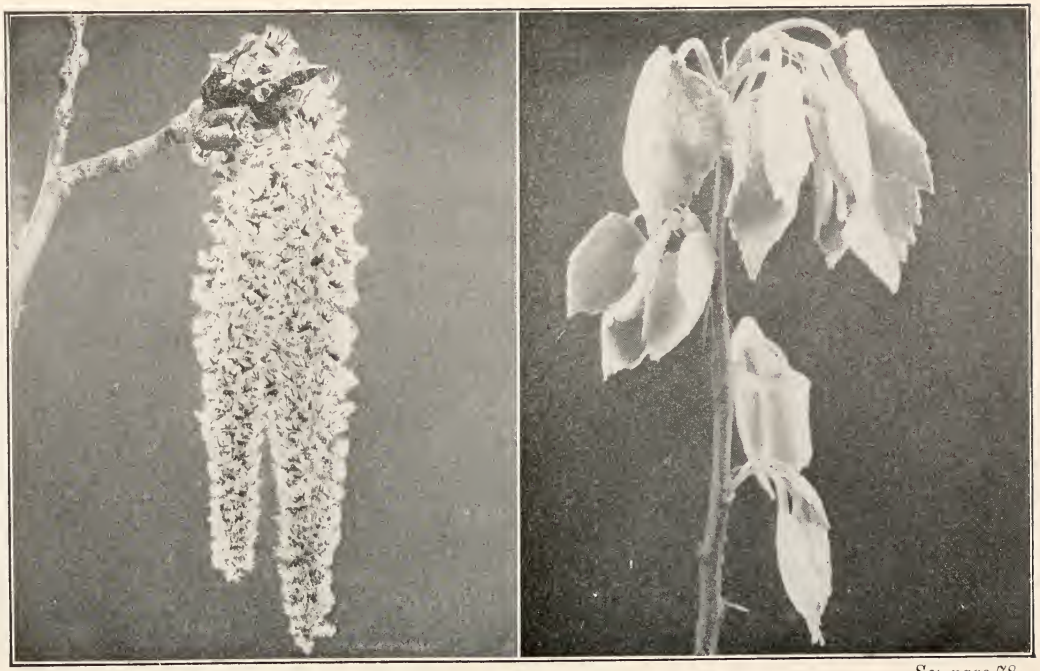
THE AMERICAN LINDEN

The broad leaves are unsymmetrical. Dry seed-balls are scattered by winter winds, the leathery bracts serving as wings



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TREMBLING ASPEN

Catkins and newly opened, flannel-like leaves

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THE PUSSY WILLOW

1—Mature staminate flower. 2—Immature staminate flowers. 3—Mature pistillate flowers

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THE AMERICAN HORNBEAM

A fruiting branch showing the thin beech-like leaves and the seeds on their leafy triangular bracts

Knowlton's Ironwood

O. Knowltoni, Cov.

Knowlton's ironwood is found nowhere but in a thick grove on the southern slope of the canyon of the Colorado in Arizona, about seventy miles north of Flagstaff. Here these trees are numerous, crouching under oaks, their twisted branches ending in drooping twigs, bearing the characteristic pale green hops in autumn, small oval leaves, and the catkin flowers in spring. Such a restricted distribution for a distinct species of trees is unmatched in the annals of botany.

THE BIRCHES

Grace and gentility of appearance are attributes of this most interesting, attractive, and valuable family of trees. *Shabby* gentility, one may insist, thinking of the untidy, frayed-out edges that adorn the silky outer bark of almost every birch tree in the woods. (*See illustration, page 102.*) Not one of them, however, but lends a note of cheerfulness to the landscape. There is beauty and daintiness in leaf, flower, and winged seed, and despite the inferiority of most birch wood, the history of the family is a long story of usefulness to the human race.

About thirty species of birches grow in the Northern Hemisphere, ten of them are North American. The white birch of Europe extends across the northern half of Asia, and is cultivated in delicate cut-leaved and weeping forms, as a lawn and park tree in this country.

The Canoe Birch

Betula papyrifera, Marsh.

The canoe birch or paper birch is the noblest member of the family. (*See cover of book.*) Ernest Thompson Seton calls it "The White Queen of the Woods—the source of food, drink, transport, and lodging to those who dwell in the forest—the most bountiful provider of all the trees." Then he enumerates the sweet syrup yielded by its sap; the meal made by drying and grinding the inner bark; the buds and catkins upon which the partridge feeds; and the outer bark, which is its best gift to primitive man.

"The broad sheets of this vegetable rawhide, ripped off when the weather is warm, and especially when the sap is moving, are tough, light, strong, pliant, absolutely waterproof, almost imperishable in the weather; free from insects, assailable only by fire. It roofs the settler's shack and the forest Indian's wigwam. It supplies cups, pails, pots, pans, spoons, boxes; under its protecting power the matches are safe and dry; split very thin, as is easily done, it is the writing paper of the woods, flat, light, smooth, waterproof, tinted, and scented; but the crowning glory of the birch is this—it furnishes the indispensable substance for the bark canoe, whose making is the highest industrial exploit of the Indian life."

From the Atlantic to the Pacific, and from our northern tier of states to the arctic seas, woodsmen, red and white, have found this white-barked tree ready to their hand, their sure defense against death by cold and by starvation. The weather is never so wet but that shreds of birch bark

burn merrily to start a campfire, and the timber of the trunk burns readily green or dry.

The White Birch

B. populifolia, Marsh.

The white birch is a small, short-lived tree that grows in swampy ground, its bark chalky white or grayish, with triangular rough patches of black, where branches are or have been. (The canoe birch has a clean bole, chalky white, with none of these ugly black patches.)

A vagabond tree it is, with thin pointed leaves and long pencil-like catkins and seed cones. The chief contributions of the poplar-leaved birch to the well-being of men are that it clothes with beauty the most uniniviting situations, and that it comes again, after fire or other general slaughter, promptly and abundantly, from stump and scattered seed.

The Yellow Birch

B. lutea, Michx.

The yellow birch shows gleams of yellow under every rent in its gray, silky, frayed-out surface. Here is a timber tree of considerable size and value: its hard wood furnishes the frames of northern sledges; the knots and burs make good mallets; the curiously knotted roots show a curly grain, valuable to the cabinet-maker. From New England to Minnesota, and south along the Appalachian range, this tree is found, always telling its name by the color of its shaggy bark.

The Red Birch

B. nigra, Linn.

Red birch or river birch wears its name in its chocolate-hued or terra-cotta bark, whose scaly surface flaunts a series of tattered fringes to the very twig ends. Tall and graceful fountains of living green, these birches lean over stream borders from Minnesota and New York to the Gulf of Mexico, and reach westward to the foothills of the Rockies. Close-grained and strong, the pale brown wood is used for furniture, shoe lasts, and a multitude of woodenwares. In the bayous of the lower Mississippi, where its roots and the base of the trunk are inundated for half the year, the tree reaches its greatest size. The cones stand erect and shed their heart-shaped, winged seeds in June—an exception to the autumn-fruiting of all other birches.

The Cherry Birch

B. lenta, Linn.

The cherry birch has dark, irregularly checked bark like the wild cherry, but the oval, pointed leaf, the catkin flowers, and the cone fruits of its family. Birch beer is made of its aromatic sap and wintergreen oil is extracted from the leaves. Indians shred the inner bark and dry it in the spring when it is rich in starch and sugar. These shreds, like vermicelli, are boiled with fish and form a nourishing dish. The wood is heavy, hard, and close-grained, valuable for the manufacture of furniture and implements, especially wheel hubs, and for fuel. It is one of the handsomest, most symmetrical, and most lux-

uriant of all our birch trees, and a worthy addition to any park.

THE ALDERS

Closely related to the hornbeams and birches is a genus of small water-loving trees that grow rapidly and serve definite, special uses in the Old and New World. The genus *alnus* includes twenty species, nine of which grow in North America; six of these reach the height of trees.

The Black Alder

Alnus glutinosa, Gaertn.

Of the alders, the black alders of Europe is the largest and most important timber tree. Its range includes western Asia and northern Africa. It was introduced successfully into our Northeastern states in colonial times and has become naturalized in many localities. These trees sometimes reach seventy feet in height and a trunk diameter of three feet. Their dark green foliage, glutinous when the leaves unfold in the spring, ranks these giant alders among the beautiful and picturesque trees.

The lumberman esteems alder wood only for special purposes. It grows in water and its wood resists decay better than any other kind when saturated through indefinite periods. In the old days it was the wood for the boat-builder. The piles of the Rialto in Venice and along the canals of Amsterdam and other Dutch cities are of black alder. Water pipes and troughs, pumps, barrel staves, kneading troughs, sabots and clogs were made of alder wood. The bark and cones are rich in tannin and a yellow

dye used in making ink. Willow and alder make the best charcoal for gunpowder. Warty excrescences on old trees and twisted roots furnished the inlayer with small but beautifully veined and very hard pieces, beautiful in veneer work when polished. In America the black alder is often met in horticultural varieties. The daintiest are the cut-leaved forms, of which *imperialis*, with leaves fingered like a white oak, is a good example.

One of the best uses to which alders are put in Europe is planting in hedges along borders of streams, where their closely interlacing roots hold the banks from crumbling and keep the current clear in midstream. No English landscape is more beautiful than one through which a little river winds, its banks and the boggy spots tributary to it softened by billows of living green. "He who would see the alder in perfection must follow the banks of the Mole and Surrey through the sweet vales of Dorking and Wickleham."

Seaside Alder

A. maritima, Nutt.

The seaside alder shares with the witch hazel the peculiar distinction of bearing its flowers and ripening its fruit simultaneously in the fall of the year. The alder comes first, hanging out its golden catkins in clusters on the ends of the season's shoots in August and September. Nothing is left of them when the witch hazel scatters its dainty stars along the twigs in October and November. The seaside alder follows stream borders near but not actually on the seacoast, through eastern Delaware and Maryland, but ranges comfortably on drier soil as far west as Oklahoma and is hardy in gardens and parks as far

north as Boston, where it blooms profusely and is much admired for both flowers and glossy foliage through the late summer.

Oregon Alder

A. Oregona, Nutt.

The Oregon or red alder reaches eighty feet in height and its trunk may exceed three feet in diameter. This Western tree exceeds the Old World alder in size. The smooth, pale-gray bark reminds us of the beech and sets this tree apart from the white alder whose bark is brown and deeply furrowed. The flowers and cone fruits are very large. The ovate leaves are cut-toothed and often lobed. This is the alder of the West Coast, largest where it comes down to the sea near the shores of Puget Sound, but climbing the mountains and canyon sides wherever there is water, from Sitka to Santa Barbara. The reddish brown wood is light, easily worked, and beautifully satiny when polished. In Washington and Oregon it is largely used in the manufacture of furniture. The Indian dug-outs are made of the butts of large trees.

THE SYCAMORES, OR BUTTONWOODS

The Buttonwood

Platanus occidentalis, Linn.

Our eastern buttonwood is a tree to which, in America, we supply the name sycamore. Its European counterpart is the plane tree of the Old World. It is one of the easiest trees to recognize, for its most prominent trait is

fairly shouted at us from a distance, whenever one of these trees comes within the range of our vision. The smooth bark that covers the branches is thin, very brittle, and has the habit of flaking off in irregular plates, leaving white patches under these plates that contrast sharply with the dingy olive of the unshed areas. On old trunks the bark is reddish brown and breaks into small, irregular plates; but above, and out among the branches, the tree looks downright untidy, and as though it had been splashed with whitewash by some careless painter. (*See illustrations, pages 102-103.*)

White birches grow in copses in low ground, a whole regiment of their white stems slanting upward. But the ghostly sycamore is apt to stand alone along the river-courses, scattered among other water-loving trees. The tree is wayward in its branching habit, its twigs irregular and angular. When the leaves are gone, it is a distressed-looking object, dangling its seed-balls in the wind until the central, bony cob is bare, the seeds having all sailed away on their hairy parachutes.

In the warmer South our buttonwood is a stalwart, large-limbed tree of colossal trunk, that shelters oaks and maples under its protecting arms. And there are some large specimens on Long Island.

The buttonwood leaf in a general way resembles a maple's, being as broad as long, with three main lobes at the top. The leaf stem forms a tent over the bud formed in summer and containing the leafy shoot of the next year. The leaf scar, therefore, is a circle and the leaf base a hollow cone. At first a sheathing stipule, like a little leafy ruffle, grows at the base of each leaf, but this is shed before midsummer.

Oriental Plane

P. Orientalis, Linn.

The oriental plane is almost as familiar a tree as our native species, for it is planted as a street tree in every city and village, and is a favorite shade and lawn tree besides. The city of Washington has set the example and so has Philadelphia. One third of the street trees of Paris are plane trees.

The chief merits of this tree immigrant are its perfect hardiness, its fine, symmetrical, compact pyramid, its freedom from injury by smoke and dust, and its rapid growth in the poor soil of the parkings of city and village. In leaf and fruit and bark-shedding habit, it is easily recognized as a sycamore, though in this species more than one ball dangles from each stem.

The exactions of city life limit the number of tree species that will do well. Our native sycamore patiently endures the foul breath of factory chimneys, and helps, in the smallest, downtown city parks, to make green oases in burning deserts of brick and stone pavements. But it is subject to the ravages of insect and fungous enemies to a greater extent than the oriental species.

THE GUM TREES

Southern people talk more about "gum trees" than people in the North. Two of our three native species of Nyssa belong solely to southern swamps, and the third, which comes north to Canada, is oftener called by other

names. All these trees are picturesque, with twiggy, contorted branches; tough, cross-grained wood; alternate, simple, leathery, but deciduous leaves, beautiful at all seasons; minute flowers and fleshy, berry-like fruits.

The Sour, or Black, Gum

Nyssa sylvatica, Marsh.

The sour or black gum of the South has a wide range, being hardy to southern Ontario and Maine. To the New Englander this is the "pepperidge"; the Indians called it "tupelo"; but the woodsman, North and South, calls it the gum tree, as a rule. "Black gum" refers to its dark gray, rough bark, which is broken into many-sided plates. By this, it is easily distinguished from the "red gum" or liquidamber, which grows in the same situations, but is not related to it. "Sour gum" refers to the acid, blue-black berries, one to three in a cluster, ripe in October.

We shall know this tree by its tall, slender trunk, clothed with short, ridged, full-twigged, horizontal branches. With no claim to symmetry, the black gum is a striking and picturesque figure in winter. It is beautiful in summer, covered with the dark polished leaves, two to four inches long. In autumn patches of red appear as the leaves begin to drop. This is the tupelo's signal that winter is coming. Soon the tree is a pillar of fire against yellowing ashes and hickories. The reds of the swamp maple and scarlet oak are brighter, but no tree has a richer color than this one. A spray brought in to decorate the mantelpiece lasts till Christmas holly displaces it. The leaves, being leathery, do not curl and dry, as do thin maple leaves, in the warm air of the house.

The Cotton Gum

N. aquatica, Marsh.

The cotton gum is draped in cottony white down as the new shoots start and the leaves unfold in spring. In midsummer this down persists in the leaf-linings, lightening the dark green of the tree-tops. The dark blue fruits of this species have no culinary value. The wood is used for crating material. The tree reaches its maximum height—one hundred feet—in the cypress swamps of Louisiana and Texas, its abundant, corky roots adapting it to its habitat.

The Sweet Gum

Liquidamber styraciflua, Linn.

The sweet gum is a tall tree with a straight trunk, four to five feet in diameter, with slender branches covered with corky bark thrown out in wing-like ridges. At first the head is regular and pyramidal, but in old age it becomes irregularly oblong and comparatively narrow. The bark is reddish brown, deeply furrowed between rough scaly plates, marked by hard, warty excrescences.

The leaves are lobed like a maple's, but more regularly, so as to form a five-pointed star. Brilliant green in summer, they become streaked with crimson and yellow. Wherever these gum trees grow, the autumn landscape is painted with the changeful splendor of the most gorgeous sunset. "The tree is not a flame, it is a *conflagration!*" Often along a country road the rail fence is hidden by an undergrowth of young gum trees. Their polished star

leaves may pass from green into dull crimsons and then into lilacs and so to brown, or they may flame into scarlets and orange instead. Always, the foliage of the sweet gum falls before it loses its wonderful colors.

The flowers of the sweet gum are knobby little bunches; the swinging balls covered with curving horns contain the winged seeds, small but shaped like the key of the maple. One recognizes the gum tree in winter by these swinging seed-balls, an inch in diameter, like the balls of the buttonwood, except that those are smooth. (*See illustrations, pages 102-103.*) The best distinguishing mark of sweet gums in winter are the corky ridges on the branches, and the star-shaped leaves under the trees. Sweet gum sap is resinous and fragrant. Chip through the bark, and an aromatic gum soon accumulates in the wound. The farther South one goes, the more copious is the exudation. In Mexico a Spanish explorer described, in 1651, "large trees that exude a gum like liquid amber." This is the "copalm balm" gathered and shipped each year to Europe from New Orleans and from Mexican ports. The fragrant gum, *storax* or *styrax*, derived from forests of the oriental sweet gum in Asia Minor, is used as incense in temples of various oriental religions. It blends with frankincense and myrrh in the censers of Greek and Roman Catholic churches. It is used in medicines also, and as a dry gum is the standard glove perfume in France.

Beautiful and interesting in every stage of growth, our native sweet gums are planted largely in the parks of Europe and are earning recognition at home, through the efforts of tree-lovers who would make the most of native species in ornamental planting.

The name, gum tree, is applied to our tupelos, and to the

great tribe of Australian eucalyptus trees, now largely planted in the Southwest.

The Osage Orange

Toxylon pomiferum, Raff.

Related to figs and mulberries, but solitary in the genus *toxylon*, is the osage orange, a handsome round-headed tree, native of eastern North America, whose fleshy roots and milky, bitter, rubbery sap reveal its family connections with the tropical rubber plants. (*See illustration, page 119.*) The fruits are great yellow-green globes, four to five inches in diameter, covered on the outside by crowded, one-seeded berries. This compound fruit reveals the tree's relationship to both figs and mulberries.

The aborigines, especially of the Osage tribe, in the middle Mississippi Valley, cherished these trees for their orange-yellow wood, which is hard, heavy, flexible, and strong—the best bow-wood to be found east of the Rocky Mountains. When the settlers came the sharp thorns with which the branches are effectually armed appealed strongly to the busy farmers and the tree was widely planted for hedges. Nurserymen produced them by thousands, from cuttings of root and branch. These trees made rapid growth and seemed most promising as a solution of the fencing problem, but they did not prove hardy in Iowa and neighboring states. Even now remnants of those old winter-killed hedges may be found on farm boundaries, individual trees having been able to survive.

The native osage orange timber is about all gone, for the rich bottom lands where it once grew most abundantly in Oklahoma and Texas have been converted into farm land.

However, the growing of osage orange timber for posts is on the increase. Systematically maintained, plantations pay well. The wood is exceptionally durable in soil. Good prices are paid for posts in local markets. Twenty-five posts can be grown to the rod in rows of a plantation; they grow rapidly and send up new shoots from the roots.

The brilliant, leathery leaves and conspicuous green fruits make this native bow-wood a very striking lawn tree. It holds its foliage well into the autumn and turns at length into a mass of gold. It harbors few insects, has handsome bark, and is altogether a distinguished, foreign-looking tree.

Experiments of feeding osage orange leaves to silkworms have been successfully made at different times, but nowhere in America has silk culture succeeded. Since the white mulberry is hardy here and its foliage is the basis of the silk-growing industry in the Old World, it is futile to look for substitutes in the osage orange or any other tree.

PART IV

TREES WITH SHOWY FLOWERS AND FRUITS

The Magnolias—The Dogwoods—The Viburnums The Mountain Ashes—The Rhododendron—The Mountain Laurel—The Madroña—The Sorrel Tree—The Silver Bell Trees—The Sweet Leaf —The Fringe Tree—The Laurel Family—The Witch Hazel—The Burning Bush—The Sumachs —The Smoke Tree—The Hollies

THE MAGNOLIAS

Four of the ten genera in the magnolia family are represented in North America. Of these, two are trees. All are known by their large, simple, alternate leaves, with margins entire; their showy, solitary, terminal flowers, perfect and with all parts distinct; and their cone-like fruits, compounded of many one- or two-seeded follicles, shingling over each other upon a central spike. The wood is soft and light throughout the family, and the roots are fleshy. The sap is watery and the bark is bitter and aromatic.

The genus *magnolia*, named by Linnaeus in honor of Pierre Magnol, a French botanist, includes twenty species; twelve are native to eastern and southern Asia, two to Mexico, and six to eastern North America. They are of

peculiar interest to horticulturists and to the general public, because they have the largest flowers of any trees in cultivation. A white blossom from six inches to a foot across is bound to attract attention and admiration when set off by a whorl of lustrous evergreen leaves. The petals of most magnolia blossoms are notably thick and waxy in texture and deliciously fragrant. Last but not least are the cone-like fruits, which flush from pale green to rose as they ripen against the dark, leathery foliage; at maturity their follicles open in a peculiar fashion and hang out their bright red seeds on slender elastic threads. Foliage, flowers, or cones alone would make magnolias superb as ornamental trees. All these qualities combined have given them a preëminent place in every country where ornamental planting is done. North America is fortunate in having so large a number of species that assume tree form.

When you see a magnolia in the North blossoming before the leaves, you may be sure it is an exotic species, and if the flowers are colored you may be equally sure that it is a hybrid between two oriental species, and belongs to the group of which the type is *M. Soulangeana.* The owner may be a magnolia enthusiast, able to show you on his premises both parents of this interesting and beautiful hybrid.

Yulan Magnolia

Magnolia Yulan

The Yulan magnolia, for centuries a favorite in Japanese gardens, covers itself before the leaves appear with pure white, fragrant flowers, bell-shaped and fully six inches across. In our Eastern gardens it is quite as much at

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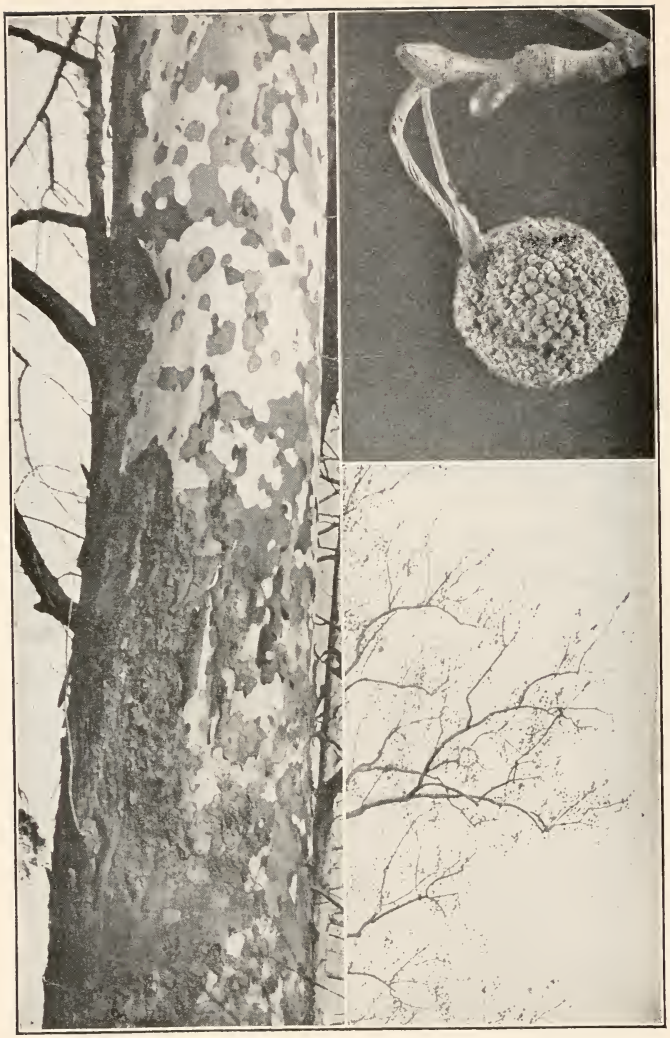
THE TATTERED, SILKY BARK OF THE BIRCHES



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BLOTCHED BARK OF THE SYCAMORE, AND THE SEED-BALLS THAT HANG ON ALL WINTER

See page 97

THE WARTY, RIDGED BARK, THE SWINGING SEED-BALLS, AND THE WINGED SEEDS OF THE SWEET GUM

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TULIP TREE, FLOWER AND LEAVES

home, and though young trees are oftenest seen, the older specimens are as large as any native magnolia. This is one parent. The other is but a shrub, the purple magnolia, *M. obovata*, that must be protected against the rigors of our Northern winters. It blooms in May or June, and its purple flowers, with rosy linings, are relatively small and almost scentless. The children of this parentage get their tints of pink and rose and crimson from this purple magnolia shrub.

Splendid, hardy, fragrant, big-flowered varieties have arisen from this cross. All are small trees, suitable for planting in city yards, where they are decorative throughout the season.

Starry Magnolia

M. stellata

The starry magnolia blooms in March or April, covering itself with star-shaped white flowers made of strap-like petals that form a flat whorl instead of a cup. This is the earliest magnolia and wonderfully precocious, blooming when scarcely two feet high.

The Southern states can grow the splendid Campbell's magnolia, which is in its glory in the high mountain valleys of the Himalayas, where it reaches one hundred feet in height. The fragrant flower-cups, from six to ten inches in diameter, shade from pink to crimson. It is rare in cultivation because it is not easy to grow, and northern horticulturists fail utterly to grow it outdoors; but the fact that it is the most beautiful of all exotic species must encourage its culture in the South, and difficulties will be overcome when the tree's peculiar needs are fully understood.

The Great Laurel Magnolia

M. foetida, Sarg.

The great laurel magnolia is oftenest seen in cultivation as a small tree of pyramidal or conical habit, with stiff, ascending branches, bearing a lustrous mass of leathery oval leaves, five to eight inches long, lined with dull green, or with rusty down, persistent until the second spring. When small these magnolia trees are as conventional as the rubber plants in hotel lobbies, whose foliage resembles theirs. But in the forests of Louisiana, where this tree reaches its greatest perfection, it earns the characterization that Sargent gave it, "the most splendid ornamental tree in the American forests." With a trunk four feet thick, and its head lifted from fifty to eighty feet above the ground and with each leaf cluster holding up a great white flower, waxy as a camellia, seven to eight inches across, the tree is indeed superb. William Bartram likened these flowers to great white roses, distinctly visible from a distance of a mile.

The purple heart of the flower, made by a spot of color at the base of each petal, and the overpowering odor, rather sickening as the flowers fade, lure insects to the nectar store at the bottom of the flower-cup. This odor, disagreeable to many people, is the one objection to this flower when brought indoors. A drawback that florists discover is that the slightest bruise of the waxy petals produces a brownish discoloration, which prevents the shipment of these flowers. The splendid foliage, however, travels perfectly, and a new and growing industry is the gathering of magnolia branches in Southern woods for

Christmas decoration. These branches are offered in all Northern cities, and this demand threatens the extinction of the tree, which until comparatively recent years has enjoyed immunity because of the worthlessness of its soft wood.

The tree's natural range is from the North Carolina coast to Tampa Bay, and west along the Gulf Coast to Texas and southern Arkansas. As an ornamental tree, it is safely planted in Philadelphia, but its life is precarious farther north. It is widely grown in southern California as a street tree, notably in Pasadena and in parks and gardens for its blossoms, foliage, and fuzzy, horny cones.

The Swamp Bay

M. glauca, Linn.

The swamp bay has lustrous, bright green leaves with silvery linings. In Florida and across to Texas and Arkansas it grows into a superb evergreen tree, fifty to seventy-five feet in height. Northward along the Atlantic Coast its growth is stunted as the climate becomes more rigorous, until it reaches Massachusetts and Long Island, where it becomes a many-stemmed shrub, whose beautiful leaves fall in the autumn. On the streets of cities near the New Jersey swamps the flowers of the swamp bay are offered for sale in May. The buds are almost globular, and each one is surrounded by a cluster of new leaves. To spring back these waxy white petals, that are marred by a touch, is criminal; but it is the common practice with boys who hawk these flowers on the streets. Most of the charm is gone from flowers thus defiled by dingy fingers.

The finest flowers are borne on strong young shoots. The florists collect and handle them with extreme care. Much of the swamp land now useless along the Atlantic seaboard could be profitably planted to this magnolia, for the florist trade alone. The flowers bloom slowly through a period of several weeks. The enterprising owner of tracts planted to swamp bay could reap two harvests a year, almost from the first season: the flowers in spring and the leafy shoots for holiday decorations. In the South the leaves are evergreen.

The Large-leaved Cucumber Tree

M. macrophylla, Michx.

The large-leaved cucumber tree exceeds all other magnolias in the size of its leaves and flowers. In fact, no tree outside the tropics can match it, for its blades are almost a yard in length. The flowers are great white bowls, sometimes a foot across, made of six white waxy petals, much broader than the three protecting sepals outside. The inner petals have purple spots at the base. The fruits are almost globular, two to three inches long, turning red as they mature, equally showy when the scarlet seeds dangle from the open follicles.

These trees are at home in fertile valleys among the foothills of the Alleghanies, from North Carolina to middle Florida, and west to central Arkansas. Their range is not continuous. They occur in scattered groups that have come from seed.

The horticulturist has greatly aided nature in the spread of this tree in this country and in Europe, where its flowers and leaves attract universal attention. The mistake

usually made is to plant it in the middle of a lawn where the wind lashes the broad leaves into ribbons before they have reached their full size. Every twig or leaf that touches a petal mars it with a brown bruise. The only way to enjoy one of these remarkable trees is to plant it in the most sheltered situation, where the sunshine will reach it and the breezes will not. Then the silver-lined foliage and the superb white blossoms can come to perfection and the sight is worth going miles to see.

The Cucumber Tree

M. acuminata, Linn.

The cucumber tree is the hardiest of our native magnolias, tropical-looking by reason of its heart-shaped leaves, six to ten inches long. Its chosen habitat is rocky uplands, where the fleshy roots can find moist soil. It ranges from western New York to Illinois, Kentucky, and Arkansas, and follows the mountain foothills through Pennsylvania and Tennessee into Alabama and Mississippi.

The flowers are like tulips, and though large can scarcely be seen among the new leaves, because they are all yellowish green in color. The petals are leaf-like and the flowers have no fragrance to make up for their lack of beauty. Imperfect pollination results in distorted, fleshy cones that resemble cucumbers that have twisted and shrunken in spots as they grew. These fruits turn from pink to red as they mature, redeeming their ugly shape by their vivid color as the leaves turn yellow. In September, the scarlet seeds hang out and the wind whips them until they dangle several inches below the fruit. One by one they drop and new cucumber trees come up from this planting.

The wood of the cucumber tree is light, close-textured, weak, and pale brown in color. It has only local use in cabinet-making and for flooring. The tree is far more valuable in horticulture. It is a splendid stock on which to graft less hardy magnolias. It is a superb avenue and shade tree for Northern cities, and in this capacity it is as yet little known. It grows vigorously from seed, and stands transplanting, if care is used that the brittle roots are not mutilated nor dried.

The Umbrella Tree

M. tripetala, Linn.

The umbrella tree has an umbrella-like whorl of leaves surrounding the flower whose white cup stands above three recurving white sepals. The whole tree suggests an umbrella, so closely thatched is its dome of thin, bright green leaves.

The stout contorted branches and twigs lack symmetry, from the forking habit. Side twigs strike out at right angles from an erect branch, then turn up into a position parallel with the parent branch, and bear terminal flowers, which induce another branching system the following year. Despite its angularity this is the trimmest and one of the handsomest of our native magnolias, and it has the merit of hardiness even in New England, where it attains large size. Its native range extends from Pennsylvania near the coast, along the Atlantic seaboard, and westward to southern Alabama and Arkansas. It loves swamp borders and the banks of mountain streams, but behaves well in the moderately rich soil of parks and gardens.

The Tulip Tree

Liriodendron tulipifera, Linn.

The tulip tree is a cousin, rather than a sister, to the foregoing magnolias. It stands alone in its genus in America, but has a sister species that grows in the Chinese interior. A tall, stately forest tree, it reached two hundred feet in height, and a trunk diameter of ten feet, in the lower Ohio Valley, when it was covered with virgin forest. This species still holds its own as a valuable lumber tree on mountain slopes of North Carolina and Tennessee. Smaller, but still stately and beautiful, it is found in woods from Vermont to Florida and west to Illinois, Arkansas, and Mississippi.

In Europe the tulip tree has been a favorite since its discovery and exportation by the American colonists. More and more it is coming to be appreciated at home as a lawn and shade tree, for there is no time in the year when it is not full of interest and beauty, and no time in its life when it is not a distinct and beautiful addition to any plantation.

In the dead of winter young tulip trees are singularly straight and symmetrical compared with saplings of other trees. There is usually a grove of them, planted by some older tree that towers overhead, and still holds up its shiny cones, that take months to give up their winged seeds. The close, thick, intricately furrowed bark of the parent tree contrasts sharply with the smooth rind of its branches and the stems of the saplings. Tulip trees are trim as beeches until the trunks are old.

The winter twigs are set with oblong blunt leaf-buds. The terminal one contains the flower, when the tree is old

enough to bloom. (*See illustration, page 103.*) In spring the terminal buds of saplings best show the peculiarity of the tree's vernation. Two green leaves with palms together form a flat bag that encloses the new shoot. Hold this bag up to the light and you see, as a shadow within, a curved petiole and leaf. The bag opens along its edge seam, the leaf-stem straightens, lifting the blade which is folded on the midrib. At the base of the petiole stands a smaller flat green bag. As the leaf grows to maturity the basal palms of its protecting bag shrivel and fall away, leaving the ring scar around the leaf base.

Now the growing shoot has carried up the second bag, which opens and another leaf expands, sheds its leafy stipules, and a third follows. The studies of this unique vernation delight children and grown-ups. It is absolutely unmatched in the world of trees.

The leathery blades of the tulip tree are from four to six inches broad and long, with basal lobes, like those of a maple leaf, and the end chopped off square. Occasionally there is a notch, made by the two end lobes projecting a trifle beyond the midrib. The leaves are singularly free from damage, keeping their dark lustrous beauty through the summer, and turning to clear yellow before they fall.

The winged seeds fall first from the top of the erect cones, the wind whirling them far, because the flat blades are long and the seed-cases light—many of them empty in fact. Far into winter a tulip tree seems to be blossoming, because its bare branches are tipped with the remnants of the seed cones, faded and shining almost white against the dark branches.

Tulip wood is soft and weak, pale brown, and light in weight. It is easily worked and is used locally for house-

and boat-building. Wood pulp consumes much of the yearly harvest. It is known as "poplar," whose wood it resembles. Ordinary postal cards are made of it. The bark yields a drug used as a heart stimulant.

THE DOGWOODS

Foliage of exceptional beauty is the distinguishing trait of the trees in the cornel family, from the standpoint of the landscape gardener and the lover of the woods. Showy flowers and fruit belong to some of the species; extremely hard, close-textured wood belongs to all; and this means slow growth, which is a limitation in the eyes of the planter who wishes quick results. But he who plants a cornel tree and watches it season after season, finds it one of the most interesting of nature studies through the whole round of the year.

The dogwoods are slender-twigged trees of small size, with simple, entire leaves, strongly ribbed, and with one exception, set opposite upon the twigs. Fifty species are distributed over the Northern Hemisphere; one crosses the equator into Peru. Four of the seventeen species found in the United States are trees; the rest are shrubs, one of them the low-growing bunchberry of our Northern woods.

The Flowering Dogwood

Cornus florida, Linn.

The flowering dogwood (*see illustration, page 134*) is a little tree whose round, bushy, flat-topped head is made of short, horizontal branches. The twigs hold erect in the winter

a multitude of buds, large, squat, enclosed in four scales, like the husk of a hickory nut. All the delicate tints that the water-colorist delights in are found in these buds and the twigs that bear them. When spring comes, these scales loosen, expand, turn green, then fade into pure white —forming the four banners, ordinarily called petals—of the bloom of the dogwood. The true flowers are small and clustered in the centre. These white expanses are merely modified bud scales, the botanist will tell you, and the notch at the end is where the horny winter scale broke away, while its base was growing into the large white palm.

From March till May one finds the dogwood clothed in white (*see illustration, page 118*), and the glossy leaves passing through changing hues from rose to green. The wayward arrangement of the blossoms on the branch is the delight of artists. Lured by the white signals, bees and other nectar-loving insects come to the flowers, cross-fertilizing them while they supply their own needs. In midsummer the pale green clusters of berries replace the flowers, and when in autumn the foliage, still glossy and smooth, changes to crimson and scarlet, the berries are brighter still, until the birds have taken every one.

The bark of the dogwood is checkered like alligator skin but with deep furrows that make it very rough. The wood is used for wood engraving blocks, for tool handles, hubs, and cogs. But it is becoming very scarce. The deplorable destruction of the dogwoods comes not so much from the lumberman as from the irresponsible people who tear the trees to pieces in blossoming time. The wanton mutilation of the dogwoods in natural woodlands belonging to cities can be curbed only by policing the tracts. The

saving of every flowering dogwood tree is a duty owed to his community by every wood-lot owner within the range of this hardy, handsome tree. Though exterminated over much of its range, it is able and willing to grow in any state east of the Mississippi River. It is one of the most deservedly popular trees planted for ornament in this country and in Europe.

Western Dogwood

C. Nuttallii, Aud.

The Pacific Coast outdoes the rest of the country in the size of its forest trees. Superlatives in vegetation abound where the breath of the Japan current tempers the air. The Western dogwood often reaches one hundred feet in height in the forests near Seattle. Its flowers have six, instead of four, of the petal-like, white bracts, each narrower and pointed, and without the terminal notch. The tree in blossom is more magnificent than the eastern species, for the flowers are often twice as large, and the spectacle of one of these trees, after the leaves turn to scarlet in autumn, and it leans against the sombre evergreens that cover the mountainside, is always startling, even in a country where surprises are the rule.

European Dogwood

C. mas.

The European dogwood or cornel is often planted in the Eastern states as an ornamental tree, but not for its flowers alone, though these tiny, button-like clusters cover the bare branches in earliest spring. The showy

fruits look like scarlet olives hanging among the glossy foliage in late summer. These fruits are edible, and in Europe are used in preserves and cordials.

THE VIBURNUMS

The honeysuckle family, which includes a multitude of ornamental shrubs, furnishes two genera with three representatives. Handsome foliage, showy flowers, and attractive fruits justify the popularity of this family in gardens and parks.

The viburnums are distributed over the Northern Hemisphere and extend into the tropics. There are about one hundred species, including the old-fashioned snowball bush, perhaps the best-known species in this country. Discriminating gardeners have replaced it by the Japanese snowball, because the latter has much more handsome foliage and perfect flowers, instead of the barren flower cluster that has nothing to show for itself once the bloom is past. This new species wears the autumn decoration of bright red berries well into the winter.

The Sheepberry

Viburnum lentago, Linn.

In our native woods the sheepberry is a small round-headed tree, with slim, drooping branches and oval leaves, finely cut-toothed and tapering to wavy-winged petioles. In autumn these leathery leaves change to orange and red, their shiny surfaces contrasting with the dull lining, pitted with black dots. The fruit, a loose cluster of dark blue

berries, on branching red stems, is an attractive color contrast, and the birds flutter in the trees until they have eaten the last one. The fragrant white flowers light up the tree from April to June with their flat clusters three to five inches across. The opposite arrangement of the leaves and that short-winged petiole identify the little tree, whether it grows by the swamp borders, along the streams, or in parks and gardens. At any season it is good to look upon. Its range covers the eastern half of the country, extending almost to the Gulf of Mexico and west into Wyoming.

The Rusty Nannyberry

V. rufidulum, Raff.

The rusty nannyberry is easily distinguished by the rusty hairs that clothe its new shoots and the stems and veins of the leaves. White flower clusters are succeeded by bright blue berries of unusual size and brilliance, ripe in October, on red-stemmed pedicles. The handsome polished leaves are rounded at the tips. The wood of this little tree has a very unpleasant odor, but this trait has no bearing upon its merits as a garden ornament. It is found wild from Virginia to Illinois and southward. In cultivation it is hardy in the latitude of Boston.

The Black Haw

V. prunifolium, Linn.

The black haw has the characteristic flowers and fruit of its genus, but is smaller throughout than the other two, and its branches are stout. In European parks and gar-

dens it is known as the "stagbush." Its fruit turns dark when dead ripe, and persists well into the winter. In the wilds, this little viburnum is found from southern New England to Michigan, and south to Georgia and Texas.

THE MOUNTAIN ASHES

The handsome foliage and showy flower clusters make the mountain ashes a favorite group of little trees for border shrubberies and other ornamental planting. The foliage is almost fern-like in delicacy and it spreads in a whorl below the flower clusters in spring and the scarlet berry clusters in autumn. Far into the winter after the foliage has dropped the berries persist, supplying the birds with food, especially in snowy winters, when their need is greatest, and brightening the dull thickets of bare twigs on dreary days.

Eastern Mountain Ash

Sorbus Americana, Marsh.

The common eastern mountain ash reaches thirty feet in height—a slender, pyramidal tree, with spreading branches and delicate leaves of from thirteen to seventeen leaflets. The flat-topped cluster of creamy white flowers (*see illustration, page 135*) appears in May and June, above the dark yellow-green foliage; and the scarlet berries, ripe in September when the leaves have turned yellow, may persist until spring. Along the borders of swamps and climbing rocky bluffs, often scattered in plum thickets, these trees are handsome at any season. Along the mountains of Tennessee and North Carolina home reme-

dies are made out of the berries. From Newfoundland to Manitoba and southward the tree grows wild and is planted for ornament in home grounds.

Elder-leaved Mountain Ash

S. sambucifolia, Roem.

The elder-leaved mountain ash overlaps the first species, and is even more daring as a climber. It ranges from Labrador to Alaska, follows the Rocky Mountains to Colorado, and in the Eastern states goes no farther south than Pennsylvania. Its leaves are graceful and drooping like the elder. The flowers and fruits are large; the whole tree tropical looking, its open, pyramidal head giving each leaf a chance at the sun.

European Mountain Ash

S. Aucuparia, Linn.[1]

Most common in cultivation is the European mountain ash called in England the rowan tree. This trim round-headed species is very neat and conventional compared with its wild cousins, but in the craggy highlands of Scotland and Wales it much resembles our mountain ashes.

Old superstitions cluster around the rowan tree in all rural sections. These are preserved in the folk-lore and the literature of many countries. Rowans were planted by cottage doors and at the gates of church yards, being considered effectual in exorcising evil spirits. Leafy twigs hung over the thresholds, crosses made of "Roan" wood given out on festival days, were worn as charms or amulets. Milkmaids, especially, depended upon these

for the defeat of the "black elves" who constantly tried to make their cows go dry, and unless prevented got into the churns—and then the butter would never come!

The farther north a tree can grow, the more likely it is to have close relatives in the Old World. One mountain ash of Japan is hardly distinguishable from our western species, and some authorities believe that our two native species are but varieties of the rowan tree of Europe.

THE RHODODENDRON

The heath family, of about sixty-seven genera, distributed over the temperate and tropical countries of the earth, has twenty-one genera in the United States, seven of which have tree representatives. Azaleas, the multitude of the heathers, the huckleberries, the madroñas, call to mind flower shows we have seen—under glass, in gardens, in parks, and among mountain fastnesses brightened by the loveliness of the mountain laurel, azalea, and rhododendron. In this wonderful family the leaves are simple and mostly evergreen. Rarely are the fruits of any importance. It is the flowers in masses that give the chief distinction to a family with over a thousand species, which have been the subjects of study and cultivation through centuries. The type of the family is the Scotch heather, immortalized in song and story. In London the Christmas season is marked by the sale of half a million little potted plants of heather! Each is about a foot in height and bears a thousand tiny bells, rosy, with white lips. This is the poor man's Christmas flower. It costs a shilling and lasts a month or more.

FLOWERING DOGWOOD

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THE OSAGE ORANGE

Flowers appear in June, after the lustrous leaves

Trees are scarce in the heath family. Shrubs are in the majority. The azaleas, which the Belgian gardeners have brought to such perfection and developed in such a great number of varieties, are among the best known of the heaths. The profuse blossoms in potted azaleas entirely extinguish the foliage, and the flowers are almost as lasting as if they were artificial.

The genus rhododendron in American woods is represented by a mountain shrub and a tree. Both are evergreen and both are widely planted for ornament during the entire season. Carloads of these wonderful plants are shipped from the mountain slopes of the Alleghanies for mass planting on rocky ground, and to cover embankments along the drives in great estates. Because of the altitude of their native habitat, they are hardy in New England, and even as far as the Great Lakes. In time of bloom, these masses are the great flower show of the countryside, and in winter nothing is more beautiful than the evergreen foliage of rhododendrons, lifted out of the snow.

Great Laurel or Rose Bay

Rhododendron maximum, Linn.

Among the Alleghany Mountains, from Virginia southward, the great laurel rises to a height of forty feet, and interlaces its boughs with those of Fraser's magnolia and the mountain hemlock in the dense forest cover. Thickets of rhododendron trees are common, and though its stature is reduced, it follows the highlands into New York, and is one of the most striking and beautiful shrubs in the Pennsylvania mountains. Scattered and becoming more rare and more stunted, it reaches Lake Erie and on

into New Brunswick. The leaves crown each of the stiff branches with an umbrella-like whorl, that stands guard in winter time about a large scaly bud. In spring the scales fall and a cone-like flower cluster rises. Each blossom is white, marked with yellow or orange spots, in the bell-like corolla's throat; or the flowers may be pale rose, with deeper tones in the unopened buds. A great tree in blossom, with its flower clusters lighting up the umbrella-like whorls of glossy, evergreen leaves, illuminates the woods, and makes every other tree look commonplace beside it.

In late summer, green capsules, each with a curving style at the top, cluster where the flowers stood, but these are scarcely ornamental. The evergreen leaves and the buds, full of promise for June blossoming, are the beautiful features of rhododendrons in winter.

The wonderful array of color and profusion of bloom, seen in an exhibit of rhododendrons and azaleas, is the most convincing proof of what crossing and careful selection can do in developing races of flowering plants. The ancestry of all these tub-plants is a matter of record, and goes back to a few comparatively insignificant wild species, competing with all the rest of the native flora for a livelihood.

THE MOUNTAIN LAUREL

The mountain laurel (*Kalmia latifolia*, Linn.) grows from Nova Scotia to Lake Erie and southward through New England and New York, and along the Alleghanies to northern Georgia. Hardier than the rhododendrons, smaller in blossoms and in foliage, the laurel is in many

points its superior in beauty. In June and July the polished evergreen foliage of the kalmia bushes is almost overwhelmed by the masses of its exquisite pink blossoms, beside which the bloom of rhododendrons looks coarse and crude in coloring. Coral-red fluted buds with pointed tips show the richest color, making with the yellow-green of the new leaves one of the most exquisite color combinations in any spring shrubbery. The largest buds open first, spreading into wide five-lobed corollas, with two pockets in the base of each forming a circle of ten pockets. Ten stamens stand about the free central pistil, and the anther of each is hid in a pocket of the corolla—the slender filament bent backward. This is a curious contrivance for insuring cross-fertilization through the help of the bees. (*See "Flowers Worth Knowing."*)

Linnaeus commemorated in the name of this genus the devoted and arduous labors of Peter Kalm, the Swedish botanist, who sent back to his master at the university of Upsala specimens of the wonderful and varied flora found in his travels in eastern North America. Most of the names accredited to Linnaeus were given to plants he never saw except as dried herbarium specimens from the New World.

THE MADROÑA

The madroña (*Arbutus Menziesii*, Pursh.), another member of the Heath family, is one of the superbly beautiful trees in the forests that stretch from British Columbia southward into California. South of the bay of San Francisco and on the dry eastern slopes of California mountains it is stunted to a shrub, but on the high, well-

drained slopes through the coast region and in the redwood forests of northern California it is a tree that reaches a hundred feet in height.

John Muir writes: "The madroña, clad in thin, smooth, red and yellow bark, with big, glossy leaves, seems in the dark coniferous forests of Washington and Vancouver Island like some lost wanderer from the magnolia groves in the South." All the year around this is one of the most beautiful of American trees. It bears large conical clusters of white flowers above the vivid green of its leathery leaves, that are wonderfully lightened by silvery linings. In autumn the red-brown of the branches is enriched and intensified by the luxuriant clusters of scarlet berries against the red and orange of the two-year-old leaves. Among the giant redwoods this tree commands the highest admiration.

THE SORREL TREE

The sorrel tree, or sour-wood (*Oxydendrum arboreum*, DC.) belongs among the heaths. Its vivid scarlet autumn foliage is its chief claim to the admiration of gardeners. In spring the little tree is beautiful in its bronze-green foliage, and in late July and August it bears long branching racemes of tiny bell-shaped white flowers. This multitude of little bells suggests the tree's relationship to the blossoming heather we see in florists' shops.

The leaves give the tree its two common names: they have a sour taste, resembling that of the herbaceous sorrels. The twigs, even in the dead of winter, yield this refreshing acid sap, that flows through the veins of the membranous leaves in summer. Many a hunter, temporarily

lost in Southern woods, quenches his thirst by nibbling young shoots of the sour-wood.

After the flower comes a downy capsule, five-celled, with numerous pointed seeds. The leaves are not unlike those of a plum tree except that they attain a length of five to seven inches. In the woods from Pennsylvania, Ohio, and Indiana, southward to Florida, Alabama, Louisiana, and Arkansas this tree ranges, and we often see it in cultivation as far north as Boston. It grows to its largest size on the western slopes of the Big Smoky Mountains in Tennessee, attaining here a height of sixty feet. In cultivation it is one of the little, slender-stemmed, dainty trees, beautiful at any season. It is the sole representative of its genus in the world, so far as botanists know.

THE SILVER BELL TREES

The silver bell tree (*Mohrodendron tetraptera*, Britt.) earns its name in May when among the green leaves the clustered bell flowers gradually pale from green to white, with rosy tints that seem to come from the ruddy flower-stems. A "snowdrop tree" may be eighty feet in height in the mountains of east Tennessee and western North Carolina, but ordinarily we see it in gardens and parks as a delicate, slender-branched tree, that stands out from every other species in the border as the loveliest thing that blooms there.

Not a moment in spring lacks interest if one has a little mohrodendron tree to watch. For weeks the ruddy twigs grow ruddier by the opening of leaf and flower buds; then comes the slow fading of the flowers, when sun and rain

seem to work together to bleach them into utter purity of color and texture. Gradually the white bells fade and a queer little green, tapering seed-case enlarges and ripens. Through the late summer these pale green fruits are exceedingly ornamental as the leaves turn to pale yellow.

In cultivation, the silver bell tree is hardy in the New England states, but in its native woods it grows north no farther than West Virginia and Illinois. It is easily transplanted and pruned to bush form, if one desires to keep the blossoming down where the perfection of the flowers can be enjoyed at close range.

Snowdrop Tree

M. diptera, Britt.

A second species called the snowdrop tree skirts the swamps along the South Atlantic and Gulf coast and follows the Mississippi bayous to southern Arkansas. It is smaller in stature than the silver bell tree, but has larger leaves and more showy flowers. The botanical names record the chief specific difference between the two species: this one has but two wings on its seed-cases, while the other has four. This species is hardy no farther north than Philadelphia. The flowers have their bells cleft almost to the base, whereas the bell of the other species is merely notched at the top.

THE SWEET LEAF

Two genera of trees in this country are temperate zone representatives of a tropical family which furnishes benzoine, torax, and other valuable balsams of commerce. It

is easy to see that these trees are strangers from warm countries, for many of their traits are singularly unfamiliar.

The Sweet Leaf

Symplocos tinctoria, L'Her.

The sweet leaf is our sole representative of a large genus of trees native to the forests of Australia and the tropics in Asia and South America. They yield important drugs and dyestuffs, particularly in British India. But the sweet leaf is a small tree, rarely over twenty feet in height, with ashy gray bark, warty and narrowly fissured. In earliest spring its twigs are clothed with yellow or white blossoms that come in a procession and cover the tree from March until May, preceding the leaves, and breathing a wonderful fragrance into the air. The leaves are small, leathery, dark green, lustrous above, deciduous in the regions of colder winters, persistent from one to two years in the warmer part of its range. The flowers are succeeded by brown berries that ripen in summer, or early autumn. The flesh is dry about the single seed.

Horses and cattle greedily browse upon the foliage, which has a distinctly sweet taste. The bark and leaves both yield a yellow dye, and the roots a tonic from their bitter, aromatic sap.

"Horse sugar" is another local name for this little tree, which is found sparingly from Delaware to Florida, west to the Blue Ridge Mountains, and in the Gulf states to Louisiana and northward into Arkansas and to eastern Texas. It is a shade-loving tree, usually found under the forest cover of taller species, skirting the borders of

cypress swamps, and climbing to elevations of nearly three thousand feet on the slopes of the Blue Ridge.

A wonderful new species of *symplocos* has come into cultivation from Japan and will enjoy a constantly increasing popularity. Its fragrant white blossoms, before the leaves, make the tree look like a hawthorn; but its unique distinction is that the racemed flowers give place to berries of a brilliant turquoise blue, which make this shrubby tree a most striking and beautiful object in the autumn when the leaves are turning yellow.

THE FRINGE TREE

Native to the middle and southern portions of the United States is a slender little tree (*Chionanthus Virginica*, Linn.), whose sister species inhabits northern and central China. Both of them cover their branches with delicate, fragrant white flowers, in loose drooping panicles, when the leaves are about one third grown. Each flower has four slender curving petals an inch long, but exceedingly narrow. In May and June the tree is decked with a bridal veil of white that makes it one of the most ethereal and the most elegant of lawn and park trees at this supreme moment of the year. Later the leaves broaden and reach six to eight inches in length, tapering narrowly to the short petioles. Thick and dark green, with plain margins, and conspicuously looped venation near the edges, these leaves suggest a young magnolia tree. Blue fruits the size of plums succeed the flowers in September, denying the magnolia theory and shading to black before they fall. The flesh is dry and seeds solitary under the thick skin of the drupe.

As in many other instances, European gardeners have led in the appreciation of this American ornamental tree. However, New England has planted it freely in parks and gardens, and popularity will follow wherever it becomes known. Its natural distribution is from southern Pennsylvania to Florida, and west to Arkansas and Texas. In cultivation it is hardy and flourishes far north of its natural range. No garden that can have a fringe tree should be without it. Fortunately its wood is negligible in quantity, and the temptation to chop down these trees does not come to the ignorant man with an axe. Whoever goes to the woods in May is rewarded for many miles of tramping if he comes upon a "snow-flower tree" in the height of its blooming season, led perhaps by its delicate fragrance when the little tree is overshadowed by the deep green of the forest cover. It is an experience that will not be forgotten soon.

THE LAUREL FAMILY

The laurel family, a large group of aromatic trees and shrubs found chiefly in the tropics, includes with our sassafras, laurels, and bays the cinnamon and camphor trees.

California Laurel

Umbellaria Californica, Nutt.

The California laurel climbs the western slopes of the Sierra Nevada from the forests of southwestern Oregon to the San Bernardino range near Los Angeles. "Up North" it is called pepperwood. It is a lover of wet soil,

so it keeps near streams. With the broad-leaved maple it gives character to the deciduous growth near the northern boundaries of California, where it reaches eighty to ninety feet in height, and a trunk diameter of four to five feet. Sometimes it is tall, but usually it divides near the ground into several large diverging stems, forming a broad round head. In southern California, and at high elevations, it oftenest occurs as a low shrub.

The willow-like leaves, lustrous and evergreen, last often through the sixth season. Unfolding in winter or early spring, they continue to appear as the branches lengthen until late in the autumn, turning to beautiful yellow or orange and falling one by one. Beginning during the second season, they continue to drop, as new shoots loosen their hold. These leaves are rich in an aromatic oil which causes them to burn readily when piled green upon a campfire. Plum-like purple fruits succeed the small white fragrant flowers, borne in clusters in the axils of the leaves. The seeds germinate before the fruit begins to decay. Indeed the plantlet has attained considerable size before the acid flesh shows any signs of change.

This tree is a superb addition to the parks and gardens of the Pacific Coast. It is strikingly handsome in a land of handsome trees, native and exotic. Its wood is the most beautiful and valuable produced in the forests of Pacific North America for the interior finish of houses and for furniture. It is heavy, hard, strong, fine-grained, light brown, of a rich tone, with paler sap-wood, that includes the annual growth of thirty or forty seasons. The leaves yield by distillation a pungent, aromatic, volatile oil, and the fruit a fatty acid commercially valuable.

The Red Bay

Persea Borbonia, Streng.

Another laurel native to stream and swamp borders, from Virginia to Texas and north to Arkansas, is the red bay, whose bark, thick, red, and furrowed into scaly ridges on the trunk, becomes smooth and green on the branches. The evergreen leaves are narrowly oval, three to four inches long, bright green, polished, with pale linings. The white flowers are very minute bells borne in axillary clusters, succeeded in autumn by blue or black shiny berries, one half inch long, one-seeded, making a pretty contrast with the clear yellow of the year-old leaves and the bright green of the new ones.

This native laurel, lover of rich, moist soil, deserves the place in cultivation more commonly granted its European cousin, *Laurus nobilis*, Linn., the familiar tub laurel of hotel verandas in the Northern states, and much grown out of doors in southern California and in milder climates east. The tree is occasionally sixty to seventy feet high, with trunk two to three feet in diameter. Such specimens furnish the cabinet-maker and carpenter with a beautiful, bright red, close-grained wood for fine interior finish and furniture. Formerly it was used in the construction of river boats, but the timber supply is now very limited.

The Avocado

P. gratissima, Gaertn.

In Florida and southern California the avocado or alligator pear is being extensively cultivated. This

laurel grows wild in the West Indies, Brazil, Peru, and Mexico. Its berry attains the size of a large pear. It has been developed in several commercial varieties, all having smooth green or purple skin, and soft oily pulp like marrow surrounding a single gigantic seed. It is usually cut in two like a melon and eaten raw as a salad dressed with vinegar, salt, and pepper. Once a stranger acquires the taste, he is extremely fond of this new salad fruit. The growing of the trees is easy and very profitable. At present the fruits are in great demand in city markets, and the prices are too high for any but the rich to enjoy this luxury.

Where a market is difficult to reach, the abundant oil is expressed from these fruits and used for illumination and the manufacture of soap. The seeds yield an indelible ink.

It is interesting to the student of trees to note how many tropical families have representation in North America, due to the fact that Florida extends into the tropics, and the West Indies seem to form a sort of bridge over which Central American and South American species have reached the Floridian Keys and the mainland.

The Sassafras

Sassafras, Karst.

The sole remnant of an ancient genus is the aromatic sassafras familiar as a roadside tree that flames in autumn with the star gum and the swamp maples. In the deep woods it reaches a height of more than a hundred feet and is an important lumber tree. In the arctic regions and in the rocky strata of our western mountains, fossil leaves of sassafras are preserved, and

the same traces are found in Europe, giving to the geologist proofs that the genus once had a much wider range than now. But no living representative of the genus was known outside of eastern North America, until the report of a recently discovered sassafras in China.

The Indians in Florida named the sassafras to the inquiring colonists who came with Columbus. They explained its curative properties, and its reputation traveled up the Atlantic seaboard. The first cargo of home products shipped by the colonists back to England from Massachusetts contained a large consignment of sassafras roots. To-day we look for an exhibit of sassafras bark in drug-store windows in spring. People buy it and make sassafras tea which they drink "to clear the blood." "In the Southwestern states the dried leaves are much used as an ingredient in soups, for which they are well adapted by the abundance of mucilage they contain. For this purpose the mature green leaves are dried, powdered (the stringy portions being separated), sifted and preserved for use. This preparation mixed with soups gives them a ropy consistence and a peculiar flavor, much relished by those accustomed to it. To such soups are given the names *gombo file* and *gombo zab*." (*Seton.*)

Emerson says that in New England a decoction of sassafras bark gave to the housewife's homespun woolen cloth a permanent orange dye. The name "Ague Tree" originated with the use of sassafras bark tea as a stimulant that warmed and brought out the perspiration freely for victims of the malarial "ague," or "chills and fever."

Sassafras wood is dull orange-yellow, soft, weak, light, brittle, and coarse-grained, but it is amazingly durable in contact with the soil, as the pioneers learned when they

used it to make posts and fence rails. It is largely used also in cooperage, and in the building of light boats. Oil of sassafras distilled from the bark of the roots is used for perfuming soaps and flavoring medicines.

With all its practical uses listed above, we must all have learned to know the tree if it grows in our neighborhood, and if we observe it closely, month by month throughout the year, we shall all agree that its beauty justifies its selection for planting in our home grounds, and surpasses all its medicinal and other commercial offerings to the world.

In winter the sassafras tree is most picturesque by reason of the short, stout, twisted branches that spread almost at right angles from the central shaft, and form a narrow, usually flat, often unsymmetrical head. The bark is rough, reddish brown, deeply and irregularly divided into broad scaly plates or ridges. The branches end in slim, pale yellow-green twigs that are set with pointed, bright green buds, giving the tree an appearance of being thoroughly alive while others, bare of leaves, look dead in winter.

What country boy or girl has not lingered on the way home from school to nibble the dainty green buds of the sassafras, or to dig at the roots with his jack-knife for a sliver of aromatic bark?

As spring comes on the bare twigs are covered with a delicate green of the opening leaves, brightened by clusters of yellow flowers (*see illustration, page 150*) whose starry calyxes are alike on all of the trees; but only on the fertile trees are the flowers succeeded by the blue berries, softening on their scarlet pedicels, if only the birds can wait until they are ripe.

Midsummer is the time to hunt for "mittens" and to

note how many different forms of leaves belong on the same sassafras tree. First, there is the simple ovate leaf; second, a larger blade oval in form but with one side extended and lobed to form a thumb, making the whole leaf look like the pattern of a mitten cut out by an unskilled hand; third, a symmetrical, three-lobed leaf, the pattern of a narrow mitten with a large thumb on each side. Not infrequently do all these forms occur on a single twig. Only the mulberry, among our native trees, shows such a variety of leaf forms as the sassafras. There is quite as great variation in the size of the leaves. One law seems to prevail among sassafras trees: more of the oval leaves than the lobed ones are found on mature trees. It is the roadside sapling, with its foliage within easy reach, that delights boys and girls with its wonderful variety of leaf patterns. Here the size of the leaves greatly surpasses that of the foliage on full-grown trees, and the autumnal colors are more glorious in the roadside thickets than in the tree-tops far above them.

Sassafras trees grow readily from seed in any loose, moist soil. A single tree spreads by a multitude of fleshy root-stalks, and these natural root-cuttings bear transplanting as easily as a poplar. Every garden border should have one specimen at least to add its flame to the conflagration of autumn foliage and the charming contrast of its blue berries on their coral stalks.

THE WITCH HAZEL

Eighteen genera compose the sub-tropical family in which *hamamelis* is the type. Two or three Asiatic species and one American are known.

The witch hazel (*Hamamelis Virginiana*, Linn.) is a stout, many-stemmed shrub or a small tree, with rough unsymmetrical leaves, strongly veined, coarsely toothed, and roughly diamond-shaped. The twigs, when bare, are set with hairy sickle-shaped buds. Nowhere in summer would an undergrowth of witch hazel trees attract attention. But in autumn, when other trees have reached a state of utter rest, the witch hazel wakes and bursts into bloom. Among the dead leaves which stubbornly cling as they yellow, and often persist until spring, the tiny buds, the size of a pinhead, open into starry blossoms with petals like gold threads. The witch hazel thicket is veiled with these gold-mesh flowers, as ethereal as the haunting perfume which they exhale. Frost crisps the delicate petals but they curl up like shavings and stay till spring. At no time is the weather cold enough to destroy this November flower show.

Among the blossoms are the pods in clusters, gaping wide if the seeds are shed; closed tight, with little monkey faces, if not yet open. The harvest of witch hazel seeds is worth going far to see. Damp weather delays this most interesting little game. Dry frosty weather is ideal for it.

Go into a witch hazel thicket on some fine morning in early November and sit down on the drift of dead leaves that carpet the woods floor. The silence is broken now and then by a sharp report like a bullet striking against the bark of a near-by trunk, or skipping among the leaves. Perhaps a twinge on the ear shows that you have been a target for some tiny projectile, sent to its mark with force enough to hurt.

The fusillade comes from the ripened pods, which have a remarkable ability to throw their seeds, and thus do for the parent tree what the winged seeds of other trees accom-

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BARK, BLOSSOM, FRUIT, AND WINTER FLOWER BUDS
OF THE FLOWERING DOGWOOD

See page 116

THE MOUNTAIN ASH

The flat, crowded cluster of tiny white flowers is set in a whorl of dark-green leaves in May or June

plish. The lining of the two-celled pod is believed to shorten and produce a spring that drives the seeds forth with surprising force when they are loosened from their attachment. This occurs when the lips part. Frost and sun seem to decide just when to spring the trap and let fly the little black seeds.

A young botanist went into the woods to find out just how far a witch hazel tree can throw its seeds. She chose an isolated tree and spread white muslin under it for many yards in four directions. The most remote of the many seeds she caught that day fell eighteen feet from the base of the tree.

The Indians in America were the first people to use the bark of the witch hazel for curing inflammations. An infusion of the twigs and roots is now made by boiling them for twenty-four hours in water to which alcohol has been added. "Witch hazel extract," distilled from this mixture, is the most popular preparation to use for bruises and sprains, and to allay the pain of burns. Druggists and chemists have failed to discover any medicinal properties in bark or leaf, but the public has faith in it. The alcohol is probably the effective agent.

Witch hazel comes honestly by its name. The English "witch hazel" is a species of elm to which superstitious miners went to get forked twigs to use as divining rods. No one in the countryside would dream of sinking a shaft for coal without the use of this forked twig. In any old and isolated country district in America there is usually a man whose reputation is based in his skilful use of a forked witch hazel twig. Sent for before a well is dug, he slowly walks over the ground, holding the twig erect by its two supple forks, one in each hand. When he passes over the

spot where the hidden springs of water are, the twig goes down, without any volition of the "water-witch." At least, so he says, and if water is struck by digging, his claims are vindicated and scoffers hide their heads.

THE BURNING BUSH

American gardeners cherish with regard that amounts almost to affection any shrub or tree which will lend color, especially brilliant color, to the winter landscape. Thus the holly, the Japanese barberry, many of the haws, the mountain ash, and the rugosa rose will be found in the shrubbery borders of many gardens, supplying the birds with food when the ground is covered with snow, and sprinkling the brightness of their red berries against the monotony of dull green conifers.

The burning bush (*Euonymus atropurpureus*, Jacq.) lends its scarlet fruits to the vivid colors that paint any winter landscape. They hang on slender stalks, clustered where the leaves were attached. Four flattish lobes, deeply separated by constrictions, form each of these strange-looking fruits. In October each is pale purplish in color and one half an inch across. Now the husk parts and curls back, revealing the seeds, each of the four enveloped in a loose scarlet wrinkled coat. Until midwinter the little tree is indeed a burning bush, glowing brighter as the advancing season opens wider the purple husks, and the little swinging Maltese cross, made by the four scarlet berries, is the only thing one sees, looking up from below. Birds take the berries, though they are bitter and poisonous.

In spring the slender branchlets of this little tree are covered with opposite, pointed leaves, two to five inches long, and in their axils are borne purplish flowers, with four spreading recurving petals. In the centre of each is supported a square platform upon which are the spreading anthers and styles. It does not require much botanical knowledge to see a family relationship between this tree and the woody vine we call "bitter-sweet"; the flowers and fruits are alike in many features.

In Oklahoma and Arkansas and eastern Texas the burning bush becomes a good-sized tree and its hard, close-grained wood is peculiarly adapted to making spindles, knitting needles, skewers, and toothpicks. "Prickwood" is the English name. Chinese and Japanese species have been added to our list of flowering trees and vines. Two shrubby species of *Euonymus* belong to the flora of North America, but the bulk of the large family is tropical.

Our dainty little American tree skirts the edges of deep woods from New York to Montana, and southward to the Gulf. In cultivation it extends throughout New England. "Wahoo," the common name in the South, is probably of Indian origin.

THE SUMACHS

The sumach family contains more than fifty genera, confined for the most part to the warmer regions of the globe. Two fruit trees within this family are the mango and the pistachio nut tree. Commercially important also is the turpentine tree of southern Europe. The Japanese lacquer tree yields the black varnish used in all lacquered

wares. The cultivated sumachs of southern Europe are important in the tanning industry, their leaves containing from twenty-five to thirty per cent. of tannic acid.

In the flora of the United States three genera of the family have tree representatives. The genus *Rhus*, with a total of one hundred and twenty species, stands first. Most of these belong to South Africa; sixteen to North America where their distribution covers practically the entire continent. Of these, four attain the habit of small trees.

Fleshy roots, pithy branchlets, and milky, or sometimes caustic or watery juice, belong to the sumachs, which are oftenest seen as roadside thickets or fringing the borders of woods. The foliage is fernlike, odd-pinnate, rarely simple. The flowers are conspicuous by their crowding into terminal or axillary panicles, followed by bony fruits, densely crowded like the flowers.

The Staghorn Sumach

Rhus hirta, Sudw.

The staghorn sumach is named for the densely hairy, forking branchlets, which look much like the horns of a stag "in the velvet." The foliage and fruit are also densely clothed with stiff pale hairs, usually red or bright yellow.

The leaves reach two feet in length, with twenty or thirty oblong, often sickle-shaped leaflets, set opposite on the stem, and terminating in a single odd leaflet. Bright yellow-green until half grown, dark green and dull above

when mature, often nearly white on the under surface, these leaves turn in autumn to bright scarlet, shading into purple, crimson, and orange. No sunset was ever more changeful and glorious than a patch of staghorn sumach that covers the ugliness of a railroad siding in October. After the leaves have fallen, the dull red fuzzy fruits persist, offering food to belated bird migrants and gradually fading to browns before spring.

The maximum height of this largest of northern sumachs is thirty-five feet. The wood of such large specimens is sometimes used for walking-sticks and for tabourets and such fancy work as inlaying. Coarse, soft, and brittle, it is satiny when polished, and attractively streaked with orange and green. The young shoots are cut and their pith contents removed to make pipes for drawing maple sap from the trees in sugaring time.

But the best use of the tree is for ornamental planting. In summer, the ugliness of the most unsightly bank is covered where this tree is allowed to run wild and throw up its root suckers unchecked. The mass effect of its fern-like foliage in spring is superb, when the green is lightened by the fine clusters of pink blossoms. No tree carries its autumn foliage longer nor blazes with greater splendor in the soft sunshine of the late year. The hairy staghorn branches, bared of leaves, hold aloft their fruits like lighted candelabra far into the waning winter. For screens and border shrubs this sumach may become objectionable, by reason of its habit of spreading by suckers as well as seed.

Its choice of situations is broken uplands and dry, gravelly banks. Its range extends from New Brunswick to Minnesota and southward through the Northern states,

and along the mountains to the Gulf states. In cultivation, it is found in the Middle West and on the Atlantic seaboard, and is a favorite in central and northern Europe.

The Dwarf Sumach

R. copallina, Linn.

The black dwarf, or mountain sumach, is smaller, with softer, closer velvet coating its twigs and lining its leaves, than the burly staghorn sumach wears. It grows all over the eastern half of the United States, even to the foothills of the Rocky Mountains, and rises to thirty feet in height above a short, stout trunk in the mountains of Tennessee and North Carolina. Its leaves are the most beautiful in the sumach family. They are six to eight inches long, the central stalk bearing nine to twenty-one dark green leaflets, lustrous above, lined with silvery pubescence. A striking peculiarity is that the central leaf-stem is winged on each side with a leafy frill between the pairs of leaflets. In autumn, the foliage mass changes to varying shades of scarlet and crimson. The flower clusters are copious and loose, and the heavy fruits nod from their great weight and show the most beautiful shades, ranging from yellow to dull red. Sterile soil is often covered by extensive growths of this charming shrubby tree which spreads by underground root-stocks. It is the latest of all the sumachs to bloom.

In the South the leaves are sometimes gathered in summer to be dried and pulverized for use in tanning leather. A yellow dyestuff is also extracted from them. It is a favorite sumach for ornamental planting in this country and in Europe.

The Poison Sumach

R. Vernix, Linn.

The poison sumach is a small tree with slender drooping branches, smooth, reddish brown, dotted on the twigs with orange-colored breathing holes, becoming orange-brown and gray as the bark thickens. The trunk is often somewhat fluted under a smooth gray rind. This is one of the most brilliant and beautiful of all the sumachs, but unfortunately *it is deadly poisonous, more to be dreaded than the poison ivy of our woods*, and the poisonwood of Florida, both of which are near relatives. By certain traits we may always know, with absolute certainty, a poison sumach when we find it. *Look at the berries. If they droop and are grayish white, avoid touching the tree*, no matter how alluring the wonderful scarlet foliage is. *Poison sumachs grow only in the swamps. We should suspect any sumach that stands with its feet in the water*, whether it bears flowers and fruit or not. The temptation is strongest when one is in the woods gathering brilliant foliage for decoration of the home for the holidays. The bitter poisonous juice that exudes from broken stems turns black almost at once. This warning comes late, however, for as it dries upon the hands it poisons the skin. Handled with care, this juice becomes a black, lustrous, durable varnish, but it is not in general use.

The Smooth Sumach

R. glabra, Linn.

The smooth sumach (*see illustrations, pages 150-151*) is quite as familiar as the staghorn, as a roadside shrub. It

forms thickets in exactly the same way, and its foliage, flowers and fruit make it most desirable for decorative planting, especially for glorious autumnal effects. The stems are smooth and coated with a pale bluish bloom. This is the distinguishing mark, at any season, of the sumach that often equals the other species in height, but does not belong in this book, for the reason that it never attains the stature of a tree.

THE SMOKE TREE

A favorite tree in American and European gardens is the smoke tree (*Cotinus*), a genus which has native representatives in both continents. The European *C. Cotinus*, Sarg., was brought to this country by early horticulturists and in some respects it is superior to our native *C. Americanus*, Nutt. Cultivation for centuries has given the immigrant species greater vigor and hardiness, which produces more exuberant growth throughout. Bring in a sapling of the native tree and it looks a starveling by comparison.

The glory of the smoke tree is the utter failure of its clustered flowers to set seed. Branching terminal panicles of minute flowers are held high above the dark green simple leaves. As they change in autumn to brilliant shades of orange and scarlet, the seed clusters are held aloft. The seeds are few but the panicles have expanded and show a peculiar feathery development of the bracts that take the place of the fruits. The clusters take on tones of pink and lavender and in the aggregate they form a great cloud made up of graceful, delicate plumes. At

a little distance the tree appears as if a great cloud of rosy smoke rested upon its gorgeous foliage. Or the haze may be so pale as to look like mist. This wonderful development of the flower cluster is unique among garden shrubs and it places *Cotinus* in a class by itself. No garden with a shrubbery border is complete without a smoke tree, which is interesting and beautiful at any season.

In its native haunts our American smoke tree is found in small isolated groves or thickets, along the sides of rocky ravines or dry barren hillsides in Missouri, Oklahoma, and Texas, and in eastern Tennessee and northern Alabama.

THE HOLLIES

The holly family, of five genera, is distributed from the north to the south temperate zones, with representation in every continent. It includes trees and shrubs of one hundred and seventy-five species, seventy of which grow in northern Brazil. The dried and powdered leaves of two holly trees of Paraguay are commercially known as maté, or Paraguay tea, to which the people of South America are addicted, as we are to the tea of China. "Yerba maté" has a remarkable, stimulating effect upon the human system, fortifying it for incredible exertions and endurance. Indulged in to excess, it has much the effect of alcohol.

China and Japan have thirty different species of holly. America has fourteen, four of which assume tree form; the rest are shrubby "winterberries."

European Holly

Ilex aquifolium, Linn.

The holly of Europe is perhaps the most popular ornamental tree in the world, cultivated in Europe through centuries, and now coming to be a favorite garden plant wherever hardy in the United States. Some indication of its popularity abroad is found in the fact that one hundred and fifty-three distinct horticultural varieties are in cultivation. The Englishman makes hedges of it, and depends upon it to give life and color to his lawn and flower borders in the winter. The fellfare or fieldfare, a little thrush, feeds upon the tempting red berries in winter; but even when these dashes of color are all gone, the brilliance of the spiny-margined leaves enlivens any landscape.

Americans know the European holly chiefly through importations of the cut branches offered in the markets for Christmas decoration. The leaf is small, brilliantly polished, and very deeply indented between long, spiny tips, giving it a far more decorative quality than the native evergreen holly of the South.

Many varieties of the European holly are found in American gardens, particularly near eastern cities. North of Washington they must be tied up in straw for the winter, and in the latitude of Boston it is a struggle to keep them alive. From southern California to Vancouver, no such precautions are necessary, and the little trees deserve a much wider popularity than they yet enjoy. Grown commercially, they are the finest of Christmas greens.

American Holly

I. Opaca, Ait.

The American holly also yields its branches for Christmas greens. In the remotest village in the North one may now buy at any grocery store a sprig of red-berried holly to usher in the holiday season. The tree is a small one at best, slow-growing, pyramidal, twenty to forty feet in height, with short, horizontal branches and tough, close-grained white wood. It is rare to find so close an imitation of ivory, in color and texture, as holly wood supplies. It is the delight of the wood engraver, who uses it for his blocks. Scroll work and turnery employ it. It is used for tool handles, walking-sticks, and whip-stocks. Veneer of holly is used in inlay work.

In southern woods and barren fallow fields where hollies grow, collectors, without discrimination, cut many trees each autumn, strip them of their branches, and leave the trunks to rot upon the ground. The increasing demand for Christmas holly seriously threatens the present supply, for no methods are being practised for its renewal. It will not be long before the wood engraver will have to buy his blocks by the pound, as he does the eastern boxwood.

The range of this holly tree extends from southern Maine to Florida, throughout the Gulf states, and north into Indiana and Missouri.

The Yaupon

I. vomitoria, Ait.

The yaupon is a shrubby tree of spreading habit, with very small, oval, evergreen leaves and red berries. It

grows from Virginia to Florida and west to Texas and Arkansas. A nauseating beverage, made by boiling its leaves, was the famous "black drink" of the Indians. A yearly ceremonial, in which the whole tribe took part, was the persistent drinking of this tea for several days, the object being a thorough cleansing of the system.

PART V

WILD RELATIVES OF OUR ORCHARD TREES

The Apples—The Plums—The Cherries—The Hawthorns—The Service-berries—The Hackberries—The Mulberries—The Figs—The Papaws—The Pond Apples—The Persimmons

THE APPLES

The chance apple tree beside the road, with fruit too gnarly to eat, is common on roadsides throughout New England. Occasionally one of these trees bears edible fruit, but this is not the rule. Perhaps the seed thus planted was from the core of a very delicious apple, nibbled close, and thrown away with regret. But trees thus planted are seedlings and seedling apple trees "revert" to the ancient parent of the race, the wild apple of eastern Asia. Horticulture began long ago to improve these wild trees, and through the centuries improvement and variation have stocked the orchards of all temperate countries with the multitude of varieties we know. A visit in October to Nova Scotia or to the Yakima Valley in Washington, is an eye-opener. Thousands of acres of the choicest varieties of this most satisfying of all fruits show the debt we owe to patient scientists, whose work has so enriched the food supply of the world.

The pear, the quince, and the curious medlar, with its core exposed at the blossom end—all relatives of the apple—trace their lineage to European and Asiatic wild ancestors. The Siberian crab, native of northern Asia, is the parent of our hard-fleshed, slender-stemmed garden crabapples. Japan has given us some wonderful apple trees, with fruit no larger than cherries, cultivated solely for their flowers. The ornamental flora of America has been greatly enriched by these varieties.

Four native apples are found in American woods. Horticulturists have produced new varieties by crossing some of these sturdy natives with cultivated apples, or their seedling offspring.

The Prairie Crab

Malus Ioënsis, Britt.

The prairie crabapple is the woolly twigged, pink-blossomed wild crab of the woods, from Minnesota and Wisconsin to Oklahoma, Texas, and Louisiana. It has crossed with the roadside "wilding" trees and produced a hybrid known to horticulture as the Soulard apple, from its discoverer. These wild trees bear fruit that is distinctly an improvement upon that of either parent. It is regarded as a distinctly promising apple for the coldest of the prairie states, and has already become the parent of several improved varieties.

The Wild Crab

M. coronaria, Mill.

Throughout the wooded regions, from the Great Lakes to Texas and Alabama, the wild crabapple brightens the

spring landscape with its rose-colored, spicy-scented blossoms. The little trees huddle together, their flat tops often matted and reaching out sidewise from under the shade of the other forest trees. The twigs are crabbed indeed in winter, but they silver over with the young foliage in April. The coral flower buds sprinkle the new leaves, and through May a great burst of rose-colored bloom overspreads the tree-tops. It is not sweetness merely that these flowers exhale, but an exquisite, spicy, stimulating fragrance, by which one always remembers them.

The pioneers made jellies and preserves out of the little green apples (*see illustrations, pages 150-151*), which lost some of their acrid quality by hanging on until after a good frost. There are those who still gather these fruits as their parents and grandparents did. In their opinion the wild tang and the indescribable piquancy of flavor in jellies made from this fruit are unmatched by those of any other fruit that grows.

THE PLUMS

The genus *prunus* belongs to the rose family and includes shrubs and trees with stone fruits. Of the over one hundred species, thirty are native to North America; but ten of them assume tree form, and all but one are small trees. Related to them are the garden cherries and plums, native to other countries, and the peach, the apricot, and the almond, found in this country only in horticultural varieties. The wood of *prunus* is close-grained, solid, and durable, and a few of the species are important timber trees. The simplest way to identify a member of

the genus is to break a twig at any season of the year and taste the sap. If it is bitter and astringent with hydrocyanic acid (the flavor we get in fresh peach-pits and bitter almonds), we may be sure we have run the tree down to the genus *prunus*.

The Wild Red Plum

Prunus Americanus, Marsh.

The wild red or yellow plum forms dense thickets in moist woods and along river banks from New York to Texas and Colorado. Its leafless, gnarled, and thorny twigs are covered in spring with dense clusters of white bloom, honey-sweet in fragrance, a carnival of pleasure and profit to bees and other insects. In hot weather this nectar often ferments and sours before the blossoms fall. The abundant dry pollen is scattered by the wind. The plum crop depends more upon wind than upon insects, for the pollination period is very brief.

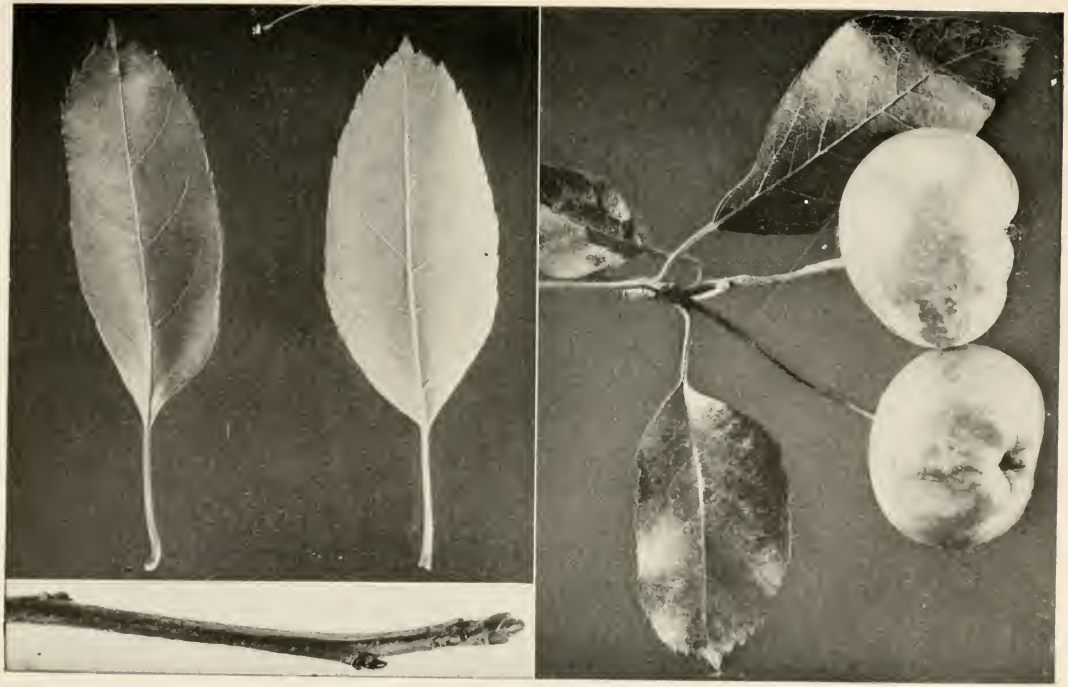
After the frost in early autumn, the pioneers of the prairie used always to make a holiday in the woods and bring home by wagon-loads the spicy, acid plums which crowded the branches and fairly lit up the thicket with the orange and red color of their puckery, thick skins. In a land where fruit orchards were newly planted, "plum butter" made from the fruit of nature's orchards was gratefully acceptable through the long winters. Even when home-grown sorghum molasses was the only available sweetening, the healthy appetites of prairie boys and girls accepted this "spread" on the bread and butter of noonday school lunches, as a matter of course.

See page 130

FLOWERS, FRUIT, AND ODD LEAF PATTERNS OF THE SASSAFRAS TREE

See page 141

FOLIAGE AND FLOWER CLUSTER OF THE SMOOTH SUMAC



See page 148

BUDS, LEAVES, AND FRUIT OF THE WILD CRABAPPLE

See page 151

THE CANADA PLUM

Its white, fragrant flowers turn pink in fading; and its stiff, zigzag branches are beset with spiny stubs

The Canada Plum

P. nigra., Ait.

The Canada plum (*see illustration, page 151*) whose range dips down into the northern tier of states, is so near like the previous species as to be called by Waugh a mere variety. Its leaves are broad and large, and the flowers and fruit larger. A peculiarity of blossoming time is that the petals turn pink before they fall. This tree furnished the settler with a relish for his hard fare, and the horticulturist a hardy stock on which to graft scions of tenderer and better varieties of plums. It is a tree well worth bringing in from the woods to set in a bare fence-corner that will be beautified by the blossoms in spring, and in late summer by the bright orange-colored fruit against the ruddy foliage.

Exotic plums have greatly enriched our horticulture, giving us fruits that vie with the peach in size and lusciousness. In New-England gardens, the damsons, green gages and big red plums are imported varieties of the woolly twigged, thick-leaved European, *P. domestica*, which refused utterly to feel at home on its own roots in the great middle prairies of the country. These European plums have found a congenial home in the mild climate of the West Coast.

Japan has furnished to the Middle West and South a hardy, prolific species, *P. triflora*, generally immune to the black knot, a fungous disease which attacks native plums. Crosses between the Japanese and American native plums promise well. California now ranks first in prune raising as an industry, with France a close second. Prunes are the dried fruit of certain sweet, fleshy kinds of plums. Many

cultivated varieties of Japanese plums have enriched the horticulture of our West Coast.

The almond, now grown commercially in California, is the one member of the genus prunus whose flesh is dry and woody, and whose pit is a commercial nut.

THE CHERRIES

Small-fruited members of the genus prunus, wild and cultivated, are grouped under the popular name, cherries, by common consent. The pie cherry of New-England gardens is *prunus cerasus*, Linn. It often runs wild from gardens, forming roadside thickets, with small sour red fruits, as nearly worthless as at home in the wilds of Europe and Asia. This tree has, through cultivation, given rise to two groups of sour cherries cultivated in America. The early, light-red varieties, with uncolored juice, of which the Early Richmond is a familiar type, and the late, dark-red varieties, with colored juice, of which the English Morello is the type.

The sweet cherry of Europe (*P. Avium*, Linn.) has given us our cultivated sweet cherries, whose fruit is more or less heart-shaped.

Japan celebrates each spring the festival of cherry blossom time, a great national fête, when the gardens burst suddenly into the marvelous bloom of *Sakura*, the cherry tree, symbol of happiness, in which people of all classes delight. The native species (*P. pseudo-Cerasus*), has been cultivated by Japanese artist-gardeners in the one direction of beauty for centuries. Not in flowers alone, but in leaf, in branching habit, and even in bark, beauty has been the

ideal toward which patience and skill have striven successfully. "Spring is the season of the eye," says the Japanese poet. Of all their national flower holidays, cherry blossom time, in the third month, is the climax.

The Wild Cherry

Prunus Pennsylvanica, Linn.

The wild red, bird, or pin cherry grows in rocky woods, forming thickets and valuable nurse trees to hardwoods, from Newfoundland to Georgia, and west to the Rocky Mountains. The birds enjoy the ruddy little fruits and hold high carnival in June among the shining leaves. Many an ugly ravine is clothed with verdure and whitened with nectar-laden flowers by this comparatively worthless, short-lived tree; and in many burnt-over districts, the bird-sown pits strike root, and the young trees render a distinct service to forestry by this young growth, which is gone by the time the pines and hardwoods it has nursed require the ground for their spreading roots.

The Wild Black Cherry

P. serotina, Ehrh.

The wild black cherry or rum cherry (*see illustration, page 166*), is the substantial lumber tree of the genus, whose ponderous trunk furnishes cherry wood, vying with mahogany and rosewood in the esteem of the cabinet-maker, who uses cherry for veneer oftener than for solid furniture.

The drug trade depends upon this tree for a tonic derived from its bark, roots, and fruit. Cherry brandies, cordials, and cherry bounce, that good old-fashioned home-

brewed beverage, are made from the heavy-clustered fruits that hang until late summer, turning black and losing their astringency when dead ripe.

From Ontario to Dakota, and south to Florida and Texas, this tree is found, reaching its best estate in moist, rich soil, but climbing mountain canyons at elevations of from five to seven thousand feet. A worthy shade and park tree, the black cherry is charmingly unconventional, carrying its mass of drooping foliage with the grace of a willow, its satiny brown bark curling at the edges of irregular plates like that of the cherry birch.

The Choke Cherry

P. Virginiana, Linn.

The choke cherry is a miniature tree no higher than a thrifty lilac bush, from the Eastern states to the Mississippi, but between Nebraska and northern Texas it reaches thirty-five feet in height. The trunk is always short, often crooked or leaning, and never exceeds one foot in diameter. Its shiny bark, long racemed flowers and fruit, and the pungent odor of its leaves and bark might lead one to confuse it with a black cherry sapling. But there is a marked difference between the two species. The choke cherry's odor is not only pungent, but rank and disagreeable besides. The leaf of the choke cherry is a wide and abruptly pointed oval. The fruit until dead ripe is red or yellow, and so puckery, harsh, and bitter that children, who eat the black cherries eagerly, cannot be persuaded to taste choke cherries a second time.

Birds are not so fastidious; they often strip the trees before the berries darken. It is probably by these un-

conscious agents of seed distribution that choke-cherry pits are scattered. From the Arctic Circle to the Gulf of Mexico, and from the Atlantic to the Rocky Mountains this worthless little choke cherry is found in all wooded regions.

THE HAWTHORNS

In the same rose family with apples, plums, cherries, and service-berries is listed the genus *Crataegus*, a shrubby race of trees, undersized as a rule, with stiff, zigzag branches set with thorns. Over one hundred species have been described by Charles Sargent in his "Manual of Trees of North America," published in 1905.

The centre of distribution for the hawthorn is undoubtedly the eastern United States. From Newfoundland the woods are full of them. A few species belong to the Rocky Mountain region, a few to the states farther west. Europe and Asia each has a few native hawthorns.

The English Hawthorn

Crataegus oxyacantha, Linn.

The English hawthorn is the best-known species in the world. When it first came into cultivation, no man knows. Englishmen will tell you it has always formed the hedgerows of the countryside. This is the "blossoming May." The sweetness of its flowers, snowy white, or pink, or rose-colored, turns rural England into a garden, while linnets and skylarks fill the green lanes with music.

American "forests primeval" were swept with the woodman's axe before the hawthorns had their chance to assert themselves sufficiently to attract the attention of

botanists and horticulturists. The showy flowers and fruits, the vivid coloring of autumn foliage, and the striking picturesqueness of the bare tree, with its rigid branches armed with menacing thorns, give most of these little trees attractiveness at any season. They grow in any soil and in any situation, and show the most remarkable improvement when cultivated. Their roots thrive in heavy clay. When young the little trees may be easily transplanted from the wild. They come readily from seed, though in most species the seed takes two years to germinate.

With few exceptions, the flowers of our hawthrons are pure white, perfect, their parts in multiples of five—a family trait. Each flower is a miniature white rose. Rounded corymbs of these flowers on short side twigs cover the tree with a robe of white after the leaves appear. In autumn little fleshy fruits that look like apples, cluster on the twigs. Inside the thick skin, the flesh is mealy and sweetish around a few hard nutlets that contain the seed. As a rule, the fruits are red. In a few species they are orange; in still fewer, yellow, blue, or black.

It is not practicable to describe the many varieties of our native hawthorns in a volume of the scope of this one. A few of the most distinctive species only can be included, but no one will ever confuse a hawthorn with any other tree.

The Cockspur Thorn

C. Crus-galli, Linn.

The cockspur thorn is a small, handsome tree, fifteen to twenty feet high, with stiff branches in a broad round head. The thorns on the sides of the twig are three to

four inches long, sometimes when old becoming branched, and reaching a length of six or eight inches. Stout and brown or gray, they often curve, striking downward as a rule, on the horizontal branches. The leaves, thick, leathery, lustrous, dark green above, pale beneath, one to four inches long, taper to a short stout stalk, seeming to stand on tiptoe, as if to keep out of the way of the thorns. From the ground up, the tree is clothed in bark that is bright and polished, shading from reddish brown to gray. The flowers come late, in showy clusters; and the fruit gleams red against the reddening leaves. As winter comes on the leaves fall and the branches are brightened by the fruit clusters which are not taken by the birds (*see illustration, page 167*). All the year long the cockspur thorn is a beautiful, ornamental tree and a competent hedge plant, popular alike in Europe and America.

The Scarlet Haw

C. pruinosa, K. Koch.

The scarlet haw found from Vermont to Georgia, and west to Missouri, prefers limestone soil of mountain slopes, and is more picturesque than beautiful. The foliage is distinctive; it is dark, blue-green, smooth, and leathery, pale beneath, and turns in autumn to brilliant orange. In summer the pale fruit wears a pale bloom but at maturity it is dark purplish red and shiny.

The Red Haw

C. mollis, Scheele

The red haw is the type of a large group, ample in size, fine in form and coloring, of fruit and foliage. This tree

reaches forty feet in height, its round head rising above the tall trunk, with stout branchlets and stubby, shiny thorns.

The twigs are coated with pale hairs, the young leaves, and ultimately the leaf-linings and petioles are hairy, and the fruits are downy, marked with dark dots.

The only fault the landscape gardener can find with this red haw, is that its abundant fruit, ripe in late summer, falls in September. The species is found from Ohio to Dakota, Nebraska, and Kansas.

The Scarlet Haw

C. coccinea, Linn.

The scarlet haw, native of the Northeastern states, is one of the oldest native thorns in cultivation. It is a favorite in New England gardens, because of its abundant bloom, deep crimson fruit and vivid autumn foliage. It is a shrubby, round-headed tree, with stout ascending branches, set with thorns an inch or more in length.

The Black Haw

C. Douglasii, Lindl.

In the West the black haw is a round-headed, native tree found from Puget Sound southward through California and eastward to Colorado and New Mexico. It is a round-headed tree reaching forty feet in height, in moist soil. Its distinguishing feature is the black fruit, ripe in August and September, lustrous, thin-fleshed, sweet, one-half an inch long. The thorns are stout and sharp, rarely exceeding one inch in length. The leathery dark-green

leaves, one to four inches long, commend this black-fruited thorn of the West to the Eastern horticulturists. It has proved hardy in gardens to the Atlantic seaboard and in Nova Scotia.

THE SERVICE-BERRIES

A small genus of pretty, slender trees related to apples, and in the rose family, has representatives in every continent of the Northern Hemisphere, and also in North Africa. Their natural range is greatly extended by the efforts of horticulturists, for the trees are among the best flowering species.

The Service-berry

Amelanchier Canadensis, T. & G.

The Eastern service-berry, June-berry, or shad-bush, is often seen in parks and on lawns; its delicate, purple-brown branches covered in April, before the oval leaves appear, with loose, drooping clusters of white flowers. (*See illustration, page 182.*) Under each is a pair of red silky bracts and the infant leaves are red and silky, all adding their warmth of color when the tree is white with bloom. The blossoms pass quickly, just about the time the shad run up the rivers to spawn. We may easily trace this common name to the early American colonists who frugally fished the streams when the shad were running, and noted the charming little trees lighting up the river banks with their delicate blossoms, when all the woods around them were still asleep. In June the juicy red berries call the birds to a feast. Then the little tree quite loses its identity, for the

forest is roofed with green, and June-berries are quite overshadowed by more self-assertive species.

The borders of woods in rich upland soil, fron Newfoundland to the Dakotas and south to the Gulf, are the habitat and range of this charming little tree.

The Western Service-berry

A. alnifolia, Nutt.

The Western service-berry grows over a vast territory which extends from the Yukon River south through the Coast Ranges to northern California and eastward to Manitoba and northern Michigan. In the rich bottom lands of the lower Columbia River, and on the prairies about Puget Sound, it reaches twenty feet in height, and its nutritious, pungent fruits are gathered in quantities and dried for winter food by the Indians. Indeed, the horticulturists consider this large juicy fine-flavored, black berry quite worthy of cultivation, as it grows in the wild to one inch in diameter—the average size of wild plums.

THE HACKBERRIES

Fifty or sixty tropical and temperate-zone species of hackberries include two North American trees which have considerable value for shade and ornamental planting. One hardy Japanese species has been introduced; three exotic species are in cultivation in the South. One is from South Africa, a second from the Mediterranean basin, and a third from the Orient.

It is easy to mistake the hackberry for an elm; the habits of the two trees lead the casual observer astray. The leaf

is elm-like, though smaller and brighter green than the foliage of the American elm. A peculiarity of the foliage is the apparent division of the petiole into three main ribs, instead of a single midrib. At base, the leaves are always unsymmetrical. The bark is broken into thick ridges set with warts, separated by deep fissures.

The absence of terminal buds induces a forking habit, which makes the branches of a hackberry tree gnarled and picturesque. The hackberry is not familiarly known by the inhabitants of the regions where it grows, else it would more commonly be transplanted to adorn private grounds and to shade village streets.

The Hackberry

Celtis occidentalis, Linn.

The hackberry reaches one hundred and twenty-five feet in height in moist soil along stream borders or in marshes. It is distributed from Nova Scotia to Puget Sound, and south to Florida, Tennessee, Missouri, Texas, and New Mexico. The beauty of its graceful crown is sometimes marred by a fungus which produces a thick tufting of twigs on the ends of branches. The name, "witches' brooms" has been given to these tufts. Growths of similar appearance and the same name are produced by insect injury on some other trees.

The fruit of the hackberry is an oblong, thin-fleshed sweet berry, purple in color, one fourth to one half inch long. It dries about the solitary seed and hangs on the tree all winter, to the great satisfaction of the birds. (*See illustration, page 183.*)

Emerson says: "The wood is used for the shafts and

axle-trees of carriages, the naves of wheels, and for musical instruments. The root is used for dyeing yellow, the bark for tanning, and an oil is expressed from the stones of the fruit."

The best use we can make of the hackberry tree is to plant it for shade and ornament. It is easily transplanted, for the roots are shallow and fibrous, so that well-grown trees may be moved in winter time. The autumn yellow of the foliage is wonderfully cheerful, and the warty bark, checked into small thick plates, is interesting at any season.

European Nettle Tree

C. Australis

The European nettle tree is supposed to have been the famous "lotus" of classical literature. Homer tells of the lotus-eaters who, when they tasted the sweet fruit, straightway forgot their native land or could not be persuaded to return. This innocent tree, against which the charge has never been proved, bears a better reputation for the qualities of its wood. It is as hard as box or holly, and as beautiful as satin-wood when polished. Figures of saints and other images are carved out of it. Hay-forks are made of its supple limbs. Rocky worthless land is set apart by law in some countries for the growing of these trees. Suckers from the roots make admirable ramrods, coach-whip stocks and walking-sticks. Shafts and axle-trees of carriages are made of the larger shoots; oars and hoops are supplied from these coppiced trees. From northern Africa, throughout Europe, and on to India, the tree is planted for shade, and its foliage is used as fodder for cattle.

THE MULBERRIES

The mulberry family includes fifty-five genera and nearly a thousand species of temperate-zone and tropical plants. The genus *ficus* alone includes six hundred species. Hemp, important for its fibrous, inner bark, and the hop vine are well known herbaceous members of the mulberry family, which stands botanically between the elms and the nettles—strange company, it would seem, but justified by fundamental characteristics. Three genera of this family have tree forms in America—the mulberry, the Osage orange, and the fig. Two native mulberries and three exotic species are widely cultivated for their fruit, their wood, and as ornamental trees. Weeping mulberries are among the most popular horticultural forms.

The Red Mulberry

Morus rubra, Linn.

The red mulberry grows to be a large dense, round-headed tree, with thick fibrous roots and milky sap. Its alternate leaves, three to five inches long, are variable in form, often irregularly lobed, very veiny, usually rough, blue-green above, pale and pubescent beneath, turning yellow in early autumn. The inconspicuous flower spikes are succeeded by fleshy aggregate fruits like a blackberry, sweet, juicy, dark purple or red, each individual fruit single-seeded. Birds and boys alike throng the trees through the long period during which these berries ripen. They are hardly worthy to rank with the cultivated mulberries as a fruit tree. But planted in poultry yards and hog pastures the

dropping fruits are eagerly devoured by the occupants of these enclosures.

The chief value of the tree lies in the durability of its orange-yellow wood, which, though coarse-grained, soft and weak, is very durable in the soil and in contact with water. Hence it has always commended itself to fence- and boat-builder. It is sometimes planted for ornament, but its dropping fruit is a strong objection to it as a street or lawn tree.

One of the mulberry's chief characteristics is its tenacity to life. Its seeds readily germinate and cuttings, whether from roots or twigs, strike root quickly. Indians discovered that rope could be made out of the bast fibre of mulberry bark. They even wove a coarse cloth out of the same material. The early settlers of Virginia, who found the red mulberry growing there in great abundance, dreamed in vain of silk culture as an industry based upon this native tree. Their hopes were not realized. Silk culture has never yet become a New-World industry.

The White Mulberry

M. alba, Linn.

The white mulberry is a native of northern China and Japan. From this region it has been extensively introduced into all warm temperate climates. Its white berries are of negligible character. It is the leaves that give this oriental mulberry a unique position in the economic world. They are the chosen food of silkworms. No substitute has ever robbed this tree of its preëminence, maintained for many centuries in its one field of usefulness.

The hardy Russian mulberries are derived from *M. alba*. These have done much to enrich the horticulture of our Northern states, but the parent tree, though it thrives in the eastern United States and in the South, has not been the means of establishing silk culture on a paying basis in this country.

The Black Mulberry

M. nigra, Linn.

The black mulberry, probably a native of Persia, has large, dark red, juicy fruits, for which it is extensively cultivated in Europe. In this country it is hardy only in the Southern and the Pacific Coast states. It is the best fruit tree of its family, yet no mulberry is able to take rank among profitable fruit trees. The fruits are too sweet and soft, and they lack piquancy of flavor. They ripen a few at a time and are gathered by shaking the trees.

The dark green foliage of the black mulberry gives ample shade throughout the season. Planted in the garden or in the border of the lawn where no walk will be defaced by the dropping fruits, the mulberry is a particularly desirable tree because it attracts some of our most desirable song-birds to build on the premises. Given a mulberry tree and a bird-bath near by, and the smallest city lot becomes a bird sanctuary through the summer and a wayside inn for transients during the two migratory seasons.

THE FIGS

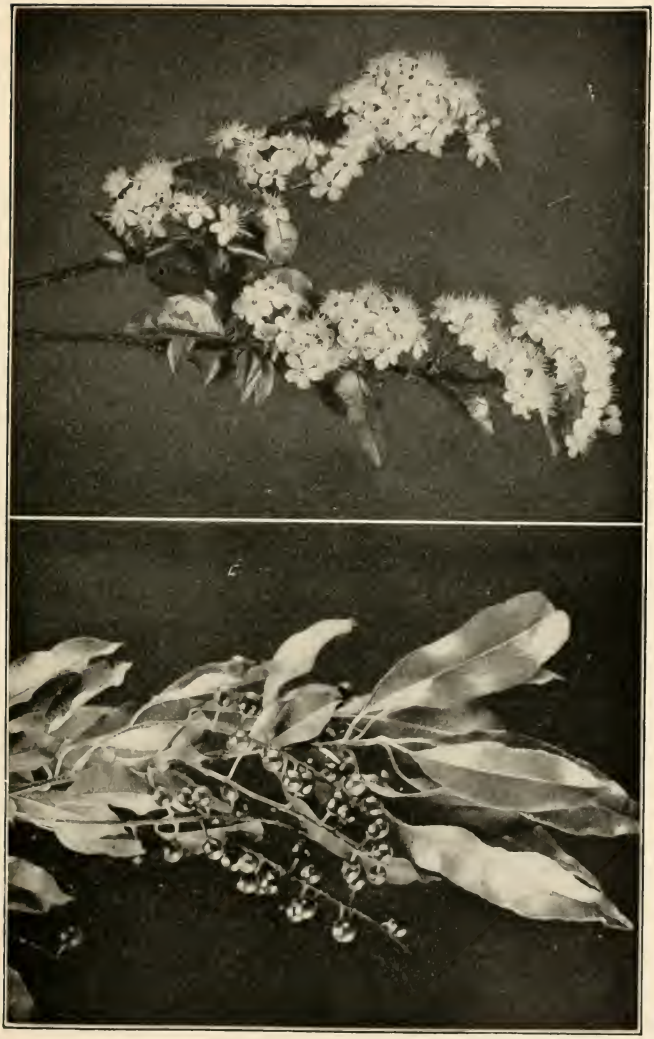
The genus *ficus* belongs to all tropical countries, and this remarkable range accounts for the six hundred differ-

ent species botanists have identified. The rubber plant, popular in this country as a pot and tub plant, is one of the best-known species. In its East Indian forest home it is the "Assam Rubber Tree." It may begin life as an air plant, fixing its roots in the crotch of another tree, in which a chance seed has lodged. A shock of aërial roots strikes downward and reaches the ground. After this the tree depends upon food drawn from the earth. The supporting host tree is no longer needed. The young rubber tree has by this time a trunk stiff enough to stand alone.

Assam rubber, which ranks in the market with the best Brazilian crude rubber, comes from the sap of this wild fig tree, *Ficus elasticus*. Clip off a twig of your leathery-leaved rubber plant and note the sticky white sap that exudes. In the highest priced automobile tires you find the manufactured product.

Dried figs have always been an important commercial fruit. These imported figs are from trees that are horticultural varieties of a wild Asiatic species, *Ficus Carica*. Smyrna figs are best for drying. They form a delicious, wholesome sweet, which has high food value and is more wholesome than candy for children. Tons of this dried fruit are imported each year from the countries east of the Mediterranean Sea. Now California is growing Smyrna figs successfully.

The banyan tree of India is famous, striking its aërial rootlets downward until they reach the ground and take root, and thus help support the giant, horizontal limbs. These amazing trees, members of the genus *ficus*, sometimes extend to cover an acre or more of ground. To walk under one is like entering the darkness of a forest of young trees. By the clearing away of most of these aërial



See page 153

FLOWERS AND FRUIT OF THE WILD BLACK CHERRY

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A FRUITING BRANCH OF THE COCKSPUR THORN

branches, a great arbor is made for the comfort of people in regions where the sun's rays are overpowering in the middle of the day.

Our own fig trees in North America are but sprawling parasitic trees, unable to stand alone. They are found only in the south of Florida, and therefore are generally unknown.

The Golden Fig

Ficus aurea, Nutt.

The golden fig climbs up other trees and strangles its host with its coiling stems and aërial roots. One far-famed specimen has grown and spread like a banyan tree, its trunk and head supported by secondary stems that have struck downward from the branches. Smooth as a beech in bark, crowned with glossy, beautiful foliage, like the rubber plants, this parasitic fig is a splendid tropical tree, but the host that supports all this luxuriance is sacrificed utterly. The little yellow figs that snuggle in the axils of the leaves turn purple, sweet, and juicy as they ripen. They are sometimes used in making preserves. An interesting characteristic of the wood of the golden fig is its wonderful lightness. Bulk for bulk, it is only one fourth as heavy as water.

THE PAPAWS

Two of the forty-eight genera of the tropical custard-apple family are represented by a solitary species each in the warmer parts of the United States. Important fruit and ornamental trees in the tropics of the Old World are

included in this family, but their New-World representatives are not the most valuable. However, they have a sufficient number of family traits to look foreign and interesting among our more commonplace forest trees; and because their distribution is limited they are not generally recognized in gardens, where they are planted more for curiosity than for ornament.

The Papaw

Asimina triloba, Dunal.

The papaw has the family name, custard-apple, from its unusual fruit, whose flesh is soft and yellow, like custard. The shape suggests that of a banana. The fruits hang in clusters and their pulp is enclosed in thick dark brown skin, wrinkled, sometimes shapeless, three to five inches long. Dead ripe, the flesh becomes almost transparent, fragrant, sweet, rather insipid, surrounding flat, wrinkled seeds an inch long. The fruit is gathered and sold in local markets from forests of these papaws which grow under taller trees in the alluvial bottom lands of the Mississippi Valley. In summer the leaves are tropical-looking, having single blades eight to twelve inches long, four to five inches broad, on short, thick stalks. These leaves are set alternately upon the twig, and cluster in whorls on the ends of branches. The flowers appear with the leaves and would escape notice but for their abundance and the unusual color of their three large membranous petals. At first these axillary blossoms are as green as the leaves; gradually the dark pigment overcomes the green, and the color passes through shades of brownish green to dark rich wine-red. The full-grown

foliage by midsummer has become very thin in texture, and lined with pale bloom. The tree throughout exhales a sickish, disagreeable odor. The fruit is improved in flavor by hanging until it gets a nip of frost.

This "wild banana tree" is the favorite fruit tree of the negroes in the Black Belt. Its hardiness is surprising. From the Southern states, it ranges north into Kansas, Michigan, New York, and New Jersey.

The Melon Papaw

Carica Papaya, Linn.

The melon papaw does not belong to the custard-apple family, but it grows in southern Florida and throughout the West Indies, and has the name of our little "wild banana tree," so it may as well have mention here, as it is the sole representative of the true Papaw family, and it is universally cultivated for its fruit in the warm regions of the world. By selection the fruit has been improved until it ranks as one of the most wholesome and important of all the fruits in the tropics. In Florida the papaw grows on the rich hummocks along the Indian River, and on the West Coast southward from Bay Biscayne. It is very common on all the West Indian Islands. It grows like a palm, with tall stem crowned by huge simple leaves, one to two feet across, deeply lobed into three main divisions, and each lobe irregularly cut by narrow sinuses. The veins are very thick and yellow, and the hollow leaf-stalks lengthen to three or four feet. The bark of this tree is silvery white—a striking contrast with the lustrous head of foliage. The flowers are waxy, tubular, fragrant, turning their yellow petals backward in a whorl. On fer-

tile trees the fruits mature into great melons, sometimes as large as a man's head; but these are the cultivated varieties. Wild papaws rarely exceed four inches long, and usually they are smaller. When full grown the fruit turns to bright orange-yellow. The succulent pulp separates easily from the round seeds.

In the West Indies, the trees often branch and attain much greater size than in Florida, where fifteen feet is the maximum, in the wilds.

The leaves of this papaw contain, in their abundant sap, a solvent, *papain*, which has the property of destroying the connective tissue in meats. They are bruised by the natives and tough meat, wrapped closely in them, becomes tender in a few hours. The fruits are eaten raw and made into preserves. Negroes use the leaves also as a substitute for soap in the washing of clothes.

THE POND APPLES

The pond apple (*Anona glabra*, Linn.) is our only representative of its genus that reaches tree form and size, and it is the second of our native custard-apples. It comes to us *via* the West Indies, and reaches no farther north than the swamps of southern Florida. It is a familiar tree on the Bahama Islands. Thirty to forty feet high, the broad head rises from a short trunk, less than two feet in diameter, but very thick compared with the wide-spreading, contorted branches and slender branchlets. It is often buttressed at the base. The leaves are oval and pointed, rarely more than four inches long, bright green, leathery, paler on the lower surface, plain-

margined. The flowers in April form pointed, triangular boxes by the touching of the tips of the yellowish white petals, whose inner surfaces near the base have a bright red spot.

The fruit, which ripens in November, is somewhat heart-shaped, four to six inches long, compound like a mulberry. The smooth custard-like flesh forms a luscious mass between the fibrous core and the surface, studded with the hard seeds. Fragrant and sweet, these wild pond apples have small merit as fruit. Little effort has been made to improve the species horticulturally. Its rival species in the West Indies have a tremendous lead which they are likely to keep.

The Cherimoya

Anona Cherimolia, Mill.

The cherimoya, native of the highlands of Central America, has long been cultivated, and its fruit has been classed, with the pineapple and the mangosteen, as one of the three finest fruits in the world. Certainly it deserves high rank among the fruits of the tropics. This also has been introduced into cultivation in southern Florida, but its culture has assumed much more importance in California, where it seems to feel quite at home.

The tree is a handsome one, with broad velvety bright green leaves, deciduous during the winter months. It grows wherever the orange is hardy, and its fruit, heart-shaped or oval, green or brown, is about the size of a navel orange. Conical protuberances cover the surface and enclose a mass of white, custard-like pulp, with the flavor of the pineapple, in which are imbedded twenty or thirty

brown seeds. A taste for this tropical pond apple is as easily acquired as for the pineapple, which has become universally popular. Every garden in the Orange Belt should have a cherimoya tree for ornament and for its fruit.

THE PERSIMMONS

The persimmon tree of the Southern woods belongs to the ebony family, which contains some important fruit and lumber trees, chiefly confined to the genus *diospyros*, which has two representatives among the trees of North America. Doubtless a climate of longer summers would enable our persimmon trees to produce wood as hard as the ebony of commerce, whose black heart-wood and thick belt of soft yellow sap-wood are the products of five different tropical species of the genus—two from India, one from Africa, one from Malaysia and one from Mauritius. The beautiful, variegated wood called *coromandel* is produced by a species of ebony that grows in Ceylon.

Fossil remains of persimmon trees are found in the miocene rocks of Greenland and Alaska, and in the later cretaceous beds uncovered in Nebraska. These prove that *diospyros* once had a much wider range than now, extending through temperate to arctic regions, whereas now our two persimmons and the Chinese and Japanese species, are the only representatives outside the tropics.

The Persimmon

Diospysos Virginiana, Linn.

The persimmon will never be forgotten by the Northerner who chances to visit his Virginia cousins in the early

autumn. Strolling through the woods he notes among other unfamiliar trees a tall shaft covered with black bark, deeply checked into squarish plates. The handsome round head, held well aloft, bears a shock of angular twigs and among the glossy, orange-red leaves hang fruits the size and shape of his Northern crabapples. The rich orange-red makes it extremely attractive, and the enthusiasm with which the entire population regards the approaching persimmon harvest focuses his interest likewise upon this unknown Southern fruit. He is eager to taste it without delay, and usually there is no one to object. Forthwith he climbs the tree, or beats a branch with a long pole until a good specimen is obtained. Its thin skin covers the mellow flesh—but the first bite is not followed by a second. The fruit is so puckery that it almost strangles one.

But after the frosts and well on into the winter the persimmons grow more sweet, juicy, and delicious, and lose all their bitterness and astringency. To find a few of these sugary morsels in the depths of the woods at the end of a long day's hunting is a reward that offsets all disappointments of an empty bag. No fruit could be more utterly satisfying to a dry-mouthed, leg-weary, hungry boy.

The opossum is the chief competitor of the local negro in harvesting the persimmon crop. Individual trees differ in the excellence of their fruit. These special trees are "spotted" months before the crop is fit to eat. It would seem as if the opossums camp under the best persimmon trees and take an unfair advantage, because they are nocturnal beasts and have nothing to do but watch and wait. One thing solaces the negro, when he sees the harvest diminish through the unusual industry and appetite of his bright-eyed, rat-tailed rival. He knows what brush-pile

or hollow tree shelters the opossom, while he sleeps by day. Every persimmon the opossom steals helps to make him fat and tender for the darkey's Thanksgiving feast, so it is only a question of patience and strategy to recoup his losses by feasting on his fat 'possum neighbor, and to boast to the friends who join him at the feast, of the contest of wits at which he came off victorious.

In summer time a persimmon tree is handsome in its oval pointed leaves, often six inches long, with pale linings. The flowers that appear in axillary clusters on the sterile trees are small, yellowish green and inconspicuous. On the fertile trees the flowers are solitary and axillary. The fruit is technically a berry, containing one to eight seeds.

The following first impressions of persimmons in Virginia woods are from the pen of a traveler in the early part of the seventeenth century, whom Pocahontas might have introduced to a fruit well known to the Indians:

"They have a plumb which they call pessemmins, like to a medler, in England, but of a deeper tawnie cullour; they grow on a most high tree. When they are not fully ripe, they are harsh and choakie, and furre in a man's mouth like allam, howbeit, being taken fully ripe, yt is a reasonable pleasant fruiet, somewhat lushious. I have seen our people put them into their baked and sodden puddings; there be whose tast allows them to be as pretious as the English apricock; I confess it is a good kind of horse plumb."

"'Simmon beer" and brandy are made from the fruit, and its seeds are roasted to use when coffee is scarce. The inner bark of the tree has tonic properties, and the country folk use it for the allaying of intermittent fevers. The wood is used in turnery, for shoe lasts, plane stocks

and shuttles. It is a peculiarity of the persimmon tree that almost one hundred layers of pale sap-wood, the growth of as many years, lie outside of the black heart-wood, upon which the reputation of ebony rests.

The Japanese Persimmon

Kaki

The native persimmon of Japan has been developed into an important horticultural fruit. China also has species that are fruit trees of merit. In the fruit stalls of all American cities, the Japanese persimmon is found in its season, the smooth, orange-red skin, easily mistaken for that of a tomato as the fruits lie in their boxes. The pointed cones differ in form, however, and the soft mellow flesh, with its melon-like seeds and leathery calyx at base, mark this fruit as still a novelty in the East.

In southern California no garden is complete without a Japanese persimmon tree to give beauty by its cheerful, leathery, green leaves and its rich-colored fruits. But the beginner will establish a grave personal prejudice against this fruit unless he wait until it is dead ripe, for it has the astringent qualities of its genus. No fruit is more delicate in flavor than a thoroughly ripe kaki, so soft that it must be eaten with a spoon.

The Department of Agriculture at Washington has established a number of varieties of these oriental fruit trees in the warmer parts of the United States. Our native persimmons are being used as stock upon which to graft the exotics. A distinct addition to the fruits of this country has thus been made and the public is fast learning to enjoy the luscious, wholesome Japanese persimmons.

PART VI

THE POD-BEARING TREES

THE LOCUSTS—THE ACACIAS OR WATTLES—OTHER POD-BEARERS

Whenever we see blossoms of the sweet-pea type on a tree or pods of the same type as the pea's swinging from the twigs, we may be sure that we are looking at a member of the pod-bearing family, *leguminosae*, to which herbaceous and woody plants both belong. The family is one of the largest and most important in the plant kingdom, and its representatives are distributed to the uttermost parts of the earth. Four hundred and fifty genera contain the seven thousand species already described by botanists. Varieties without number belong to the cultivated members of the family, and new forms are being produced by horticulturists all the time. This great group of plants has fed the human race, directly and indirectly, since the First Man appeared on earth. Clovers, alfalfas, lentils, peas, beans yield foodstuffs rich in all the elements that build flesh and bone and nerve tissues. They take the place of meat in vegetarian dietaries.

Besides foods, the pod-bearers yield rubber, dyestuffs, balsams, oils, medicinal substances, and valuable timber. A long list of ornamental plants, beautiful in foliage and flowers, occurs among them, chiefly of shrub and tree form.

Last, but not least, among their merits stands the fact that leguminous plants are the only ones that actually enrich the soil they grow in, whereas the rest of the plant creation feed upon the soil, and so rob it of its plant food and leave it poorer than before.

Pod-bearers have the power to take the nitrogen out of the air, and store it in their roots and stems. The decay of these parts restores to the soil the particular plant food that is most commonly lacking and most costly to replace. Farmers know that after wheat and corn have robbed the soil of nitrogen, a crop of clover or cow peas, plowed under when green and luxuriant, is the best restorer of fertility. It enriches by adding valuable chemical elements, and also improves the texture of the soil, increasing its moisture-holding properties, which commercial fertilizers do not.

Seventeen genera of leguminous plants have tree representatives within the United States. These include about thirty species. Valuable timber trees are in this group. All but one, the yellow-wood, have compound leaves, of many leaflets, often fernlike in their delicacy of structure, and intricacy of pattern. With few exceptions the flowers are pretty and fragrant in showy clusters. The ripening pods of many species add a striking, decorative quality to the tree from midsummer on through the season. Thorns give distinction and usefulness to certain of these trees, making them available for ornamental hedges.

THE LOCUSTS

Three representatives of the genus *robinia* are among our native forest trees. They are known in early summer by

their showy, pea-like blossoms in full clusters, and their compound leaves, that have the habit of drooping and folding shut their paired leaflets when night comes on, or when rain begins to fall. The pods are thin and small, splitting early, but hanging late on the twigs.

The Black Locust

Robinia Pseudacacia, Linn.

The black or yellow locust is a beautiful tree in its youth, with smooth dark rind and slender trunk, holding up a loose roundish head of dark green foliage. Each leaf is eight to fourteen inches long, of nine to nineteen leaflets, silvery when they unfold, and always paler beneath. In late May, the tree-top bursts into bloom that is often so profuse as to whiten the whole mass of the dainty foliage. The nectar-laden, white flowers have the characteristic "butterfly" form, the banner, wings, and keel of the type pease-blossom. (*See illustration, page 198*). The bees lead the insect host that swarms about them as long as a locust flower remains to offer sweets to the probing tongues. Cross-fertilization is the advantage the tree gains for all it gives. The crop of seeds is sure.

The angled twigs of the black locust break easily in windy weather. The rapid growth of the limbs spreads the narrow head, and its symmetry is soon destroyed, unless the tree grows in a sheltered situation. An old locust is usually an ugly, broken specimen, ragged-looking for three-fourths of the year. The twigs look dead, because their winter buds are buried out of sight! The bark is dull, deeply cut into irregular, interlacing furrows, roughened by scales and shreds on the ridges. In winter the pods

chatter querulously, as the wind plays among the tree-tops.

The black locust is found from Pennsylvania to Iowa, and south from Georgia to Oklahoma. The lumber is coarse-grained, heavy, hard, and exceptionally durable in contact with the soil or water. This makes it especially adaptable for fence posts and boat bottoms. Crystals, called *raphides*, in the wood cells, take the edges off tools used in working locust lumber. Yet it is sought by manufacturers of mill cogs and wheel hubs, and railroad companies plant the trees for ties.

The locust-borer has ruined plantations of this tree of late years, and trees in the woods have become infested except in mountainous regions not yet reached by the pest. Trees become distorted with warty excrescences and the lumber is riddled with burrows made by the larvae. Until the entomologist finds a remedy in some natural parasite of the locust-borer, the outlook for locust culture seems dark enough. No insecticide can reach an enemy that hides in the trunk of the tree it destroys.

The Clammy Locust

R. viscosa, Vent.

The clammy locust has beautifully shaded pink flowers in clusters, each blossom accented by the dark red, shiny calyx, and the glandular exudation of wax, that covers all new growth. A favorite ornamental locust, this little tree has been widely distributed in this and other temperate countries of the globe. Its leaves are delicately feathery, with the dew-like gum brightening them, as it does also the hairy, curling pods that flush as they ripen. In winter the

twigs are ruddy. The trees grow wild on the mountains of the Carolinas and nowhere else.

The Honey Locust

Gleditsia triacanthos, Linn.

The honey locust is a tall handsome flat-topped tree, with stiff horizontal, often drooping branches, ending in slim brown polished twigs, with three-branched thorns, stout and very sharp, set a little distance above the leaf scar of the previous season. Occasionally a thornless tree occurs.

Inconspicuous greenish flowers, regular, bell-shaped, appear in elongated clusters, the fertile and sterile clusters distinct, but on the same tree. The leaves are almost full-grown when the blossoms appear. Their feathery, fern-like aspect is the tree's greatest charm in early June. When the pods replace the flowers they attract attention and admiration as their velvety surfaces change from pale green to rose and they curve, as they lengthen, into all sorts of graceful and fantastic forms. The sweet, gummy pulp of the honey locust pods is considered edible by boys, who brave the thorns to get them. As the autumn approaches, the pulp turns bitter, and dries around the shiny black seeds. The purple pods cling and rattle in the wind long after the yellow leaves have fallen. One by one, they are torn off, their S-curves tempting every vagrant breeze to give them a lift. On the crusty surface of snowbanks and icy ponds, they are whirled along, and finally lodge, to rot and liberate the seeds. It takes much soaking to prepare the adamantine seeds for sprouting. The planter scalds his seed to hasten the process. Nature soaks,

freezes, and thaws them, and thus the range of the honey locust is extended.

In the wild, this tree is found from Ontario to Nebraska, and south to Alabama and Texas. It chooses rich bottom lands, but is found also on dry gravelly slopes of the Alleghany Mountains. Trunks six feet in diameter are still in existence, preserved from the early forests of the Wabash Basin in Indiana. They tower nearly one hundred and fifty feet above the ground, and their branches are a formidable array of thorns (*see illustration, page 198*), that have grown into proportions unmatched in trees of slender build and fewer years. Such a veteran honey locust is one of the most picturesque figures in a winter landscape.

Honey locust wood is hard, coarse-grained, heavy, and durable in contact with water and soil. It is made into wheel-hubs, fence-posts, and fuel. In all temperate countries this species has been used as a shade and ornamental tree and as a hedge plant.

The Kentucky Coffee Tree

Gymnocladus dioicus, K. Koch

The Kentucky coffee tree is the one clumsy, coarse member of a family that abounds in graceful, dainty species. Its head is small and unsymmetrical, above a trunk that often rises free from limbs for fifty feet above ground. The branches are stiff and large, bare until late spring, when the buds expand and the shoots are thrown out. The leaves are twice compound, often a yard in length and half as wide; the leaflets, six to fourteen on each of the five to nine divisions of the main rib. No other locust can boast a leaf

numbering more than one hundred leaflets, each averaging two inches in length. When the tree turns to gold in autumn, it is a sight to draw all eyes.

The flower spray is large, but the flowers are small, imperfect, salver-form, purplish green—the fertile ones forming thick, clumsy pods that dangle in clusters, and seem to weigh down the stiff branchlets. The fresh pulp used to be made into a decoction used in homeopathic practice. The ripe seeds were used in Revolutionary times as a substitute for coffee. How the pioneer ever crushed them is a puzzle to all who have tried to break one with a nutcracker. In China the fresh pulp of the pods of a sister species is used as we use soap.

The wood is not hard, but in other respects it resembles other locust lumber. It is sometimes used in cabinet work, being a rich, reddish brown, with pale sapwood.

The range of the coffee tree extends from New York to Nebraska, and south through Pennsylvania, Tennessee and Oklahoma, with bottom lands as the tree's preference. Nowhere is this species common. Occasionally, it is planted as a street tree, in this country and abroad.

The Redbud

Cercis Canadensis, Linn.

The redbud covers its delicate angled, thornless branchlets with a profusion of rosy-purple blossoms, typically pea-like, before the leaves appear. The unusual color, so abundant where little redbuds form thickets on the outskirts of a woodland, leads to a very general recognition of this tree among people who go into the April woods for early violets. It vies with the white banner of the shad-

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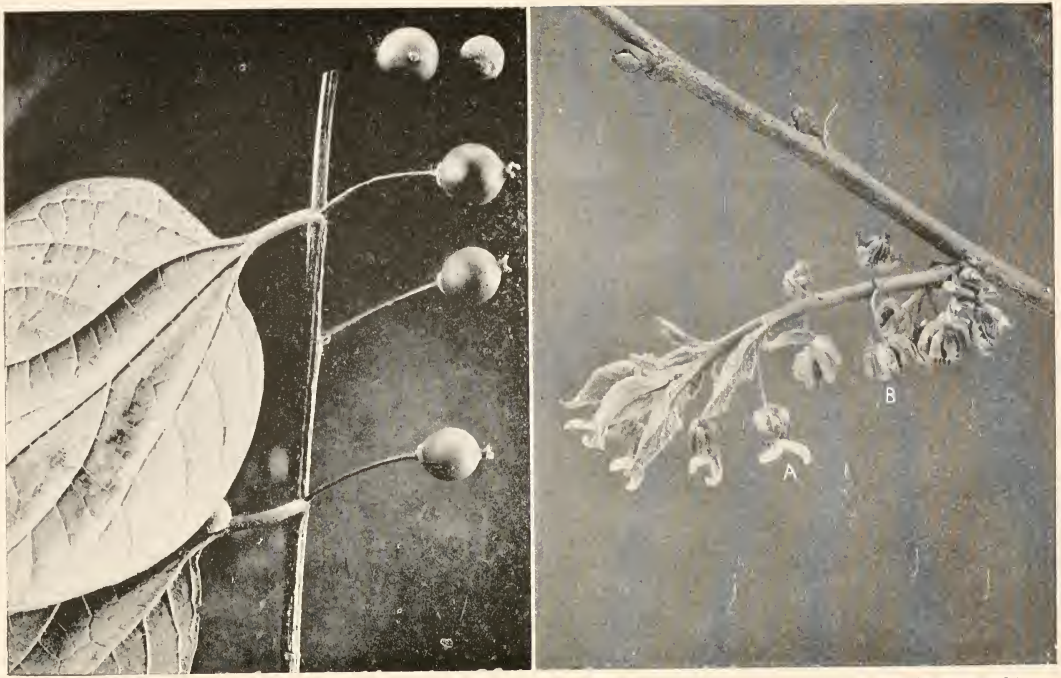
SERVICE-BERRY TREE IN BLOSSOM

The flowers appear in April, before the leaves



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THE HACKBERRY

Leaves, berries, and (A) pistillate and (B) staminate flowers

bush, in doing honor to the spring. Later, the broad heart-shaped leaves cover and adorn the tree, concealing the dainty tapering pods that turn to purple as the polished leaf blades, unmarred by insect or wind, change from green to clear yellow before falling.

Tradition has given this charming little locust tree the name, "Judas-tree," from its European cousin, rumored to have been the one upon which the choice of Judas fell when he went out and hanged himself. It is an unearned stigma, better forgotten, for it does prejudice the planter against a tree that should be on every lawn, preferably showing its rosy flowers against a bank of evergreens.

Its natural range extends from New Jersey to Florida and west from Ontario to Nebraska and southward. The largest specimens reach fifty feet in height in Texas and Arkansas, in river bottom lands, and in the Southwest the tree is an abundant undergrowth—making a beautiful woodland picture in early spring.

The Yellow-wood

Cladrastis lutea, K. Koch.

The yellow-wood was named by the wife of a pioneer, surely, for she soaked the chips and got from them a clear yellow dye, highly prized for the permanent color it gave to her homespun cotton and woolen cloth that must have gone colorless, but for dyestuffs discoverable in the woods.

The satiny grain of the wood, and its close hard texture, commended it to the woodsman, who used it for gun stocks. But the tree is too small to be important for the lumber it yields.

In winter the smooth pale bark of the "Virgilia," as the

nurseryman calls it, reminds one of the rind of the beech. The broad rounded head, often borne on three or more spreading stems, is formed of drooping graceful branches, ending in brittle twigs. Summer clothes these twigs with a light airy covering of compound leaves, of seven to eleven broadly oval leaflets, on a stalk less than a foot in length. In autumn, the foliage turns yellow.

White flowers, pea-like, delicate, fragrant, in clusters a foot long, and so loose that the flowers seem to drip from the twig ends, drape the tree in white about the middle of June, when the young leaves show many tints of green to form a background for the blossoms.

This is the supreme moment of the year for one of the most charming of trees, in any park that cherishes one of these virgilias. In the wilds of eastern Tennessee, northern Alabama, and central Kentucky the species is found in scattered places. But the wild trees have scant food and they show it. The full beauty of the species is seen only in cultivation, as one sees it in the Arnold Arboretum, and in private gardens near Boston. Even the little pods, thin, satiny pointed, add a harmonious note of beauty, their silvery fawn color blending with the quiet Quaker drab worn by the tree all winter. Fortunately, this hardy beautiful park tree is easily raised from seeds and from root cuttings. It thrives on soil of many different kinds. It has no bad habits, no superior, and few equals among flowering trees.

THE ACACIAS, OR WATTLES

Australia has contributed to southern California's tree flora a large number of forms of the acacia tribe, shrubs

and trees of great variety and beauty of flowers and evergreen foliage. They are hardy and perfectly at home, and are planted in such profusion as to be the commonest of all street and ornamental trees. The leaves are set on a branching pinnate stem, making them "twice compound" of many tiny leaflets, fascicled on the sides of the twigs, alternate on the terminal shoots of the season. The lacy, fern-like foliage of most acacias would justify the planting of them for this trait alone. But the abundant mass of bloom usually overwhelms the tree-tops, obscuring the foliage with a veil of golden mesh. Sometimes white, but oftenest yellow, the individual flowers are very small; but they crowd in button-like heads or elongated spikes, set close in axillary clusters. In their native woods these trees flower much less freely than in the land of their adoption. The curling pods are in most species and varieties ornamental, as they pass through many color changes before they finally discharge their seeds.

Acacias compose a genus of four hundred species, and an untold and constantly increasing number of cultivated varieties. The continent of Australia has the greatest representation of native species. Others belong to Africa—tropical, northern, and southern regions. Asia, in its warmer southern territory, and in southwestern China, has many native acacias. Tropical and temperate South America, the West Indies, Central America, Mexico, the southwestern region of the United States, and the islands of the South Pacific, all have representatives of this wonderful and far-scattered genus. There is no country interested in horticulture that does not grow acacias as ornamental shrubs and trees, even if they must be grown under glass the year round. In southern England the acacias,

grown in open ground, and known as "tassel trees," attain good size.

Valuable lumber, tanbarks, dyes, perfumes, and drugs are yielded by acacias. Gum Arabic is the dried sap of several oriental species, particularly, *Acacia Arabica*, Linn. of Egypt and southern Asia.

As a rule, acacias have slender branches armed with spines. Often these are too small to attract notice, or to make the species useful as a hedge plant. All spines are modifications of the stipules at the base of leaf or leaflet. Thorns, however, are modified twigs, strong, stiff and sharp, often branched. The honey locust shows true thorns, not spines or prickles. The armament of canes of blackberry is only skin deep. This means of defence is best called "prickles."

The Black Acacia

Acacia melanoxylon

The black acacia, called at home in Australian woods, the "blackwood-tree," for its black heart-wood, is a familiar street and shade tree in California. In narrow parkings it is likely to surprise the planter by outgrowing in a few years the space allotted to it, and upheaving both cement walk and curb, by the irresistible force of its thick roots. It is one of the large timber acacias, and even in the cool climate of England reaches fifty feet.

In suitable situations in California it grows much higher, and its compact conical head of dense evergreen foliage, gives abundant shade at all seasons. The flowers are white or cream-colored, lightening the yellow-green of the

new shoots and the dull, opaque of the older leaves, with abundant clusters in earliest spring. The succeeding fruits are curling thin pods that hang in brownish sheaves, giving the tree a rusty look. Each seed is rimmed with a frill of terra cotta hue that serves as a wing for its flight, when detached by the wind. The roots send up suckers and the seeds are quick to grow. So any one can have black acacias with little trouble or expense. Its shedding of leaves and pods makes much litter, however, a trait sometimes overlooked which seriously diminishes its desirability as a street and shade tree.

The Silver Wattle

A. dealbata

The silver wattle of nursery catalogues is named for its abundant, silvery-pubescent, feathery foliage. Its flowers—fluffy golden balls, small but abundant—make this a wonderfully showy tree.

Sea-green and turquoise-blue leaves, with abundant canary-yellow bloom, are traits of many different acacias in cultivation, all of which are rapid growers, and soon repay the planter who wants quick results. From being mere ornaments they rise to the stature of shade trees, and merely multiply the charms that made them admired when young. Varieties with sharp spines are employed as hedge plants. Curious leaf forms and unusual, edgewise position of the foliage, make us wonder at some of the glorious "golden wattles" and "knife-leaved acacias," that bring us glimpses of the forests of Australia and other strange far countries.

OTHER POD-BEARERS

The Mesquite

Prosopis juliflora, DC.

The mesquite or honey pod is one of the wonderful plants of the arid and semi-arid regions from Colorado and Utah to Texas and southern California. At best it is a tree sixty feet high along the rivers of Arizona. In the higher and more desert stretches it is stunted to a sprawling shrub, with numerous stems but a few feet high. Its leaves are like those of our honey locust but very much smaller, and the tree furnishes little shade. The bark of the trunk is thick, dark reddish brown, shallowly fissured between scaly ridges. In winter the tree looks dead enough, but the young shoots clothed with tender green bring it to life in early spring, and the greenish fragrant flowers, thickly set in finger-like clusters, appear in successive crops from May to July. These are succeeded by pods four to nine inches long in drooping clusters, each containing ten to twenty beans.

Not its beauty of leaf and blossom but its usefulness is what makes this tree almost an object of worship to desert dwellers, red men and white. The long fat pods supply Mexicans and Indians with a nutritious food, green or ripe. Cattle feed upon the young shoots and thrive, when other forage is scant or utterly lacking. The fuel problem of the desert is solved by the mesquite in a way that is a great surprise to the newcomer. His sophisticated neighbor

takes him on a wood-gathering expedition. Stopping where a shrubby mesquite sprawls, he hitches his team to a chain or rope that lays hold of the trunk, and hauls the plant out by its roots. And what roots the mesquite has developed in its search for water! There is a central tap root that goes down, down, sometimes sixty feet or more. Secondary roots branch out in all directions, interlock, thicken, and form a labyrinth of woody substance, in quantity and quality that makes the timber above ground a negligible quantity. This wood is cut into building and fencing materials—two great needs in the desert. The waste makes good fuel, and every scrap is precious. Posts, railroad ties, frames for the adobe houses, furniture, fellies of wheels, paving blocks, and charcoal are made of this wonderful tree's root system. A gum resembling gum-arabic exudes from the stems.

The Screw-bean

P. pubescens, Benth.

The screw-bean or screw-pod mesquite is a small slender-trunked tree with sharp spines at the bases of the hoary foliage. The marked distinction between this species and the preceding one is in the fruit, which makes from twelve to twenty turns as it matures, and forms when ripe a narrow straight spiral, one to two inches long; but when drawn out like a coiled spring the pod is shown to be more than a foot in length. These sweet nutritious pods are a most useful fodder for range cattle, and the wood is used for fencing and fuel. This tree grows from southern Utah and Nevada through New Mexico and Arizona into San

Diego County, California, western Texas and northern Mexico.

The Palo Verde Acacia

Cercidium Torreyanum, Sarg.

The palo verde is another green-barked acacia whose leaves are almost obsolete. Miniature honey-locust leaves an inch long unfold, a few here and there in March and April, but they are gone before they fully mature, and the leaf function is carried on entirely by the vivid green branches. Clustered flowers, like little yellow roses, cover the branches in April, and the pointed pods ripen and fall in July.

In the Colorado desert of southern California, in the valley of the lower Gila River in Arizona, on the sides of low canyons and on desert sandhills into Mexico, this small tree, with its multitude of leafless, ascending branches, is one of the brightest features on a hopelessly dun-colored landscape.

The Jamaica Dogwood

Icthyomethia Piscipula, A. S. Hitch.

The Jamaica dogwood is a West Indian tree that grows also in southern Florida and Mexico. It is one of the commonest tropical trees on the Florida West Coast from the shores of Bay Biscayne to the Southern Keys. The leaves are four to nine inches long, with leaflets three to four inches in length, deciduous, vivid green, making a tree fifty feet high an object of tropical luxuriance. Its beauty is greatly enhanced in May by the opening of the pink, pea-like blossoms that hang in drooping clusters a foot or more

in length. The necklace-like pods are frilled on four sides with thin papery wings.

The wood of this tree is very durable in contact with water, besides being heavy, close-grained, and hard. It is locally used in boat-building, and for fuel and charcoal. All parts of the tree, but especially the bark of the roots, contain an acid drug of sleep-inducing properties. In the West Indies the powdered leaves, young branches, and the bark of the roots have long been used by the natives to stupefy fish they try to capture.

The Horse Bean

Parkinsonia aculeata, Linn.

The horse bean or retama, native to the valleys of the lower Rio Grande and Colorado River, is a small graceful pod-bearing tree of drooping branches set with strong spines, long leaf-stems, branching and set with many pairs of tiny leaflets.

The bright yellow, fragrant flowers are almost perennial. In Texas the tree is out of bloom only in midwinter. In the tropics, it is ever-blooming. The fruit hangs in graceful racemes, dark orange-brown in color, and compressed between the remote beans. As a hedge and ornamental garden plant, this tree has no equal in the Southwest. It is met with in cultivation in most warm countries.

The Texas Ebony

Zigia flexicaulis, Sudw.

The Texas ebony is a beautiful, acacia-like tree of southern Texas and Mexico. One of the commonest and most

beautiful trees on the bluffs along the coast, south of the Rio Grande. Its leaves are feathery, fern-like, its flowers in creamy clusters, its pods thick, almost as large as those of the honey locust. The seeds are palatable and nutritious, green or ripe. Immature, the pods are cooked like string beans; ripe, they are roasted, and the pods themselves are ground and used as a substitute for coffee.

The wood is valuable in fine cabinet work, and because it is almost indestructible in contact with the ground, it is largely used for fence posts. It makes superior fuel. Besides being more valuable than any other tree of the Rio Grande Valley, though it rarely exceeds thirty feet in height, it is worthy of the attention of gardeners as well as foresters in all warm temperate countries. Prof. Sargent calls it the finest ornamental tree native to Texas.

The Frijolito

Sophora secundiflora, DC.

The frijolito or coral-bean is a small, slender narrow-headed tree, with persistent, locust-like leaves, fragrant violet-blue flowers, and small one-sided racemes. The pods are silky white, pencil-like, constricted between the bright scarlet seeds. The tree grows wild in canyons in southern Texas and New Mexico, forming thickets or small groves in low moist limestone soil and stream borders. It is a close relative of the famous pagoda tree of Japan, *S. Japonica*, universally cultivated; and it deserves to be a garden tree throughout the Southern states.

PART VII

DECIDUOUS TREES WITH WINGED SEEDS

The Maples—The Ashes—The Elms

THE MAPLES

A single genus, *acer*, includes from sixty to seventy species, widely distributed over the Northern Hemisphere. A single species goes south of the equator, to the mountains of Java. All produce pale close-grained, fairly hard wood, valued in turnery and for the interior finish of houses. The clear sap of some American species is made into maple sugar.

The signs by which we may know a member of the maple family are two: opposite, simple leaves, palmately veined and lobed; and fruits in the form of paired samaras, compressed and drawn out into large thin wings. No amount of improvement changes these family traits. No other tree has both leaves and fruits like a maple's.

The distribution of genus *acer* is interesting. The original home of the family is in the Far East. In China and Japan we may reckon up about thirty indigo maples, while only nine are native to North America. Of these, five are in the eastern half of the continent, three in the West, and one grows indifferently on both sides of the Great Divide.

The Sugar Maple

Acer saccharum, Marsh.

The sugar maple (*see illustration, page 198-199*) is economically the most important member of its family in this country. As an avenue and shade tree it is unsurpassed. It is the great timber maple, whose curly and birds-eye wood is loved by the cabinet-maker; and whose sap boiled down, yields maple sugar—a delicious sweet, with the distinctive flavor beloved by all good Americans. In October the sugar maple paints the landscape with yellow and orange and red. Its firm broad leaves, shallowly cleft into five lobes, are variously toothed besides. The flowers open late, hanging on the season's shoots in hairy yellow clusters. The key fruits are smooth and plump, with wings only slightly diverging. They are shed in midsummer.

Hard maple wood outranks all other maple lumber, though the curly grain and the bird's-eye are accidental forms rarely found. Flooring makes special demands upon this wood. Much is used in furniture factories; and small wares—shoe lasts, shoe pegs and the like—consume a great deal. As fuel, hard maple is outranked only by hickory. Its ashes are rich in potash and are in great demand as fertilizer in orchards and gardens.

The living tree, in the park, on the street, casting its shade about the home, or glowing red among the trees of the woods, is more valuable than its lumber. Slow-growing, strong to resist damage by storm, clean in habit and beautiful the year round—this is our splendid rock maple. Rich, indeed, is the city whose early inhabitants chose it as the permanent street tree.

The Black Maple

A. nigrum, Michx.

The black maple is so like the sugar maple that they are easily confused, but its stout branchlets are orange-colored, the leaves are smooth and green on both sides, scantly toothed, and they droop as if their stems were too weak to hold up the blades. The keys spread more widely than those of the sugar maple.

The black maple is the sugar maple of South Dakota and Iowa. It becomes rarer as one goes east. It is an admirable lumber tree, as well as a noble street and shade tree.

Two soft maples are found in the eastern part of the country, their sap less sweet, their wood softer than the hard maples, and their fitness for street planting correspondingly less.

The Red Maple

A. rubrum, Linn.

The red maple is a lover of swamps. It thrives, however, on hillsides, if the soil be moist; and is planted widely in parks and along village streets. In beauty it excels all other maples. In early spring its swelling buds glow like garnets on the brown twigs (*see illustrations, pages 198-199*). The opening flowers have red petals, and the first leaves, which accompany the early bloom, are red. In May the dainty flat keys, in clusters on their long, flexible stems, are as red as a cock's comb, and beautiful against the bright green of the new foliage. In early September in New England, a splash of red in the woods.

across a swamp, is sure to be a scarlet maple that suddenly declares its name. Against the green of a hemlock forest these maples show their color like a splash of blood. The tree is gorgeous.

In winter the lover of the woods, re-visiting the scenes of his summer rambles, knows the scarlet maple by the knotty, full-budded twigs which gleam like red-hot needles set with coral beads, against the clean-limbed, gray-trunked tree. The red maple never quite forgets its name.

As a street tree, it makes rapid progress when it once becomes established, though it is apt to stand still for a time after being transplanted. Its branches are short, numerous, and erect, making a round head, admirably adapted to the resistance of heavy winds. It is particularly suited to use in narrow streets.

The Soft Maple

A. saccharinum, Linn.

The soft maple or silver maple (*see illustration, page 199*) has a white-lined leaf, cleft almost to the midrib and each division again deeply cut. It is quick and ready to grow, and has been widely planted as a street tree, especially in prairie regions of uncertain rainfall. It is one of the poorest of trees for street planting, because it has a sprawling habit and weak brittle wood. The heavy limbs have great horizontal spread, and are easily broken by ice and windstorms. When planted on streets, they require constant cutting back to make them even safe. Thick crops of suckers rise from the stubs of branches, but the top thus formed is neither beautiful nor useful.

Wier's weeping maple, a cut-leaved, drooping variety

of this silver maple, is often seen as a lawn tree, imitating the habit of the weeping willow.

The Oregon Maple

A. macrophyllum, Pursh.

The Oregon maple grows from southern Alaska to Lower California, along the banks of streams. The great leaves, often a foot in diameter, on blades of equal length, are the distinguishing marks of this stout-limbed tree, that grows in favorable soil to a height of a hundred feet. In southern Oregon it forms pure forest, its huge limbs forming magnificent, interlacing arches that shut out the sun and make a wonderful cover for ferns and mosses far below. The wood of this tree is the best hard-wood lumber on the West Coast.

The Vine Maple

A. circinatum, Pursh.

The vine maple reminds one of the lianas of tropical woods, for it has not sufficient stiffness to stand erect. It grows in the bottom lands and up the mountain sides, but always following water-courses, from British Columbia to northern California. Its vine-like stems spring up in clusters from the ground, spreading in wide curves, and these send out long, slender twigs which root when they touch the ground, thus forming impenetrable thickets, often many acres in extent.

The leaf is almost circular and cut into narrow equal lobes around the margin; green in midsummer, it changes to red and gold in autumn, and the woodsman, almost

worn out with the labor of getting through the maze these trees form, must delight, when he stops to rest, in the autumn glory of this wonderful ground cover.

These little maples lend a wonderful charm to the edges of forest highways in the Eastern states. Like the hornbeams, hazel bushes, and ground hemlock, they are lovers of the shade; and they fringe the forest with a shrubbery border.

The Striped Maple

A. Pennsylvanicum, Linn.

The striped maple is quickly recognized by the pale white lines that streak in delicate patterns the smooth green bark of the branches. The leaves are large and finely saw-toothed, with three triangular lobes at the top. The yellowish bell-flowers hang in drooping clusters, followed by the smooth green keys, in midsummer. This tree is called "Moosewood," for moose browse upon it.

The shrubbery border of parks is lightened in autumn by the yellow foliage of this little tree, and in winter the bark is very attractive. "Whistlewood" is the name the boys know this tree by, for in spring the bark slips easily, and they cut branches of suitable size for whistles.

The Mountain Maple

A. spicatum, Lam.

The mountain maple is a dainty shrub with ruddy stems, large, three-lobed leaves, erect clusters of yellow flowers and tiny brown keys. It follows the mountains from New England to northern Georgia, and from the Great Lakes extends to the Saskatchewan.

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THE THORNY TRUNK OF THE HONEY LOCUST, AND THE FOLIAGE AND FLOWERS OF THE BLACK LOCUST

See page 194

SUGAR MAPLE

Maple sugar is made in February; the trees bloom in May; their seeds ripen in October

See page 195

THE RED MAPLE'S PISTILLATE (*left*) AND STAMINATE (*right*) FLOWERS

See page 196

SEED KEYS AND NEW FOLIAGE OF THE SOFT OR SILVER MAPLE

The Dwarf Maple

A. glabrum, Torr.

The dwarf maple ranges plentifully from Canada to Arizona and New Mexico. Its leaves, typically three-lobed and cut-toothed, vary to a compound form of three coarse-toothed leaflets. The winged keys are ruddy in midsummer, lending an attractive dash of color to the woods that border high mountain streams.

Very common in cultivation are the Japanese maples—miniature trees, bred and cultivated for centuries, wonderful in the variations in form and coloring of their leaves. Tiny maple trees in pots are often very old. Some leaves are mere skeletons.

The Japanese people are worshippers of beauty and they delight particularly in garden shows. In the autumn, when the maples have reached perfection, the populace turns out in holiday attire to celebrate a grand national fête. A sort of æsthetic jubilee it is, like the spring jubilee of the cherry blossom To each careful gardener who has patiently toiled to bring his maples to perfection, it is sufficient reward that the people make this annual pilgrimage to view them.

The Box Elder

A. Negundo, Linn.

The box elder is the one maple whose leaves are always cleft to the stem, making it compound of irregularly toothed leaflets. The clusters of flattened keys, which hang all winter on the trees, declare the kinship of this tree to the maples.

Fast-growing, hardy, willing to grow in treeless regions, this tree has spread from its eastern range throughout the plains, where shelter belts were the first needs of the settlers. Pretty at first, these box elders are soon broken down and unsightly. They should be used only as temporary trees, alternating with elms, hard maples, and ashes. Where they are neglected, or continue to be planted, the character of the town or the premises must be cheap and ugly.

The Norway Maple

A. platanoides, Linn.

The Norway maple is counted the best maple we have for street planting. Broad, thin leaves, three-lobed by wide sinuses, cover with a thick thatch the rounded head of the tree. Green on both sides, thin and smooth, these leaves seem to withstand remarkably the smoke, soot, and dust of cities, and also the attacks of insects. The keys are large, wide-winged, set opposite, the nutlets meeting in a straight line. These pale green key clusters are very handsome among the green leaves in summer—the tree's chief ornament until the foliage mass turns yellow in autumn. A peculiarity of the Norway maple is the milky juice that starts from a broken leaf-stem.

The Sycamore Maple

A. pseudo-platanus, Linn.

The sycamore maple is another European immigrant, whose broad leaf is thick and leathery in texture, and pale underneath. Its late-opening flowers are borne in

long racemes, followed by the small key fruits which cling to the twigs over winter, making the tree look dingy and untidy. This tree has not the hardiness nor the compact form of the Norway maple, and it is subject to the attack of borers.

It is the "sycamore" of Europe, famed as a lumber and an avenue tree abroad, but with us it proves short-lived, and we have no reason for choosing it. The copious seed production of the far preferable Norway maple puts it within the reach of all.

THE ASHES

Few large trees in our American woods have their leaves set opposite upon the twig. Still fewer of the trees with compound leaves show this arrangement. Consult the first broad-leaved tree you meet, and the chances are that its leaves are set alternately upon the twigs. There is a multitude of families in this class; but if the leaves are paired and set opposite, we narrow the families to a very few. Are the leaves simple? Then the tree may be a maple or a dogwood, or a viburnum. Are the leaves opposite and compound? Then you have one of two families. Are the leaflets clustered on the end of the leaf-stalk? Then the tree is a buckeye or a horse chestnut—members of the buckeye family. Are the leaflets set along the sides of the central stem? Then the tree is an ash. A few exceptions may be discovered, but the rule holds in the general forest area of North America.

Ash trees have lance-shaped, winged seeds, borne in profuse clusters, and often held well into the winter. But

there is no season when the leaf arrangement cannot be at once determined by the leaf scars, prominent upon the twigs; and under the tree there will always be remnants of the cast-off foliage, to show that it is compound.

Ash trees are usually large and stately when full grown, with trunks clothed in smooth bark, checked into small, often diamond-shaped plates. This gives the trees a trim, handsome appearance in the winter woods. As shade trees, ashes are very desirable, and they are valuable for their timber.

The near relatives of ashes surprise us. They belong to the olive family, whose type is the olive tree of the Mediterranean region, now extensively cultivated in California for its fruit. Privets, lilacs, and forsythias, favorites in the gardens of all countries that have temperate climates, are cousins to the ash tree. One of its most charming relatives is the little fringe tree of our own woods. Thirty species of ash are known; half of that number inhabit North America. There are ash trees in every section of our country except the extremes of latitude and altitude. Tropical ash trees are native to Cuba, North Africa, and the Orient.

The White Ash

Fraxinus Americana, Linn.

The white ash is one of the noblest trees in the American forest, the peer of the loftiest oak or walnut. When young it is slim and graceful, but it grows sturdier as it approaches maturity, lifting stout, spreading branches above a tall, massive trunk. In the forest the head is narrow, but in the open the dome of a white ash is as broad and symmetrical as that of a white oak. A gray rind covers the

young branches and the bark is gray. The foliage has white lining and each of the seven leaflets has a short stalk. These are all characters that distinguish the white ash from other species and enable one to name it at a glance. In the South the white ash is undersized and the wood is of poor quality. In the Northeastern and Central states it is one of the most important and largest of our timber trees, with wood more valuable than any other ash. Its uses are manifold: it is staple in the manufacture of agricultural implements, carriages, furniture, and in the interior finish of buildings. Tool handles and oars are made of white ash and it is superior as fuel. The reddish-brown heart-wood, with paler sap-wood, is tough, elastic, hard, and heavy. It is not durable in soil and becomes brittle with age.

Ash trees are late in coming into leaf. When all the forest is green and full of blossoms, the ash trees are still naked. Not until May do the rusty yellow winter buds of the white ash swell and throw out on separate trees their staminate and pistillate flower clusters from the axils of last year's foliage. (*See illustration, page 214.*) Then the leaves unfold; downy at first, becoming bright and shiny above, but always with pale linings. On fertile trees the inconspicuous flowers mature into pointed fruits, one to two inches long. The wing is twice the length of the seed and is rounded to a blunt point. The seed itself is round and pointed, on branching stalks that form clusters from six to eight inches long.

As a street tree the white ash deserves much more general favor in cities than it has yet achieved, for it is straight and symmetrical, and its light foliage grows in irregular, wavy masses, through which some sunlight can

always sift and let grass grow under the tree. This tree is a rapid grower, perfectly hardy in most sections of the country, and has no serious insect enemies. The foliage turns to brownish purple and yellow in the autumn.

The Black Ash

F. nigra, Marsh.

The black ash is a lover of marshes, found from Newfoundland to Manitoba, and from Virginia to Arkansas. Its blue-black winter buds, the sombre green of its foliage, and the dark hues of its bark and wood have justified the popular name of this handsome, slender tree. The leaflets, oval and long-pointed, are sessile on the hairy leaf stalk, except the terminal one. At maturity the leaves are a foot or more in length, of seven to eleven leaflets, that turn brown and fall early in autumn. The keys of the black ash are borne in open panicles, eight to ten inches long; each has a short, flat seed, with a broad blade, thin, rounded, and notched instead of pointed, at the extremity.

The wood of black ash has the tough, heavy coarse-grained qualities of the white ash, but differs in being very durable and in being easily split into thin layers—each a year's growth. The Indians taught the early settlers to weave baskets out of black ash splints. These splints are easily separated by bending the split wood over a block. The strain breaks loose the tissue that forms the spring wood, and separates the bands of tough, dense summer wood into strips suitable for basket weaving. Black ash is used for chair seats, barrel hoops, furniture, and cabinet-

work. The saplings are oftenest chosen for hop and bean poles.

As a lawn tree, the black ash has little to recommend it for it often dies of thirst in the loam of a garden. At best it is short-lived. Planted in swampy ground, the tree spreads by seeds, and suckers from the roots, soon forming extensive thickets, and drinking up the moisture at a marvelous rate.

The Red Ash

F. Pennsylvanica, Marsh.

The red ash follows the courses of streams and lake margins from New Brunswick to the Black Hills and south into Florida, Alabama, and Nebraska. This tree is much planted for shade and ornament in New England, and in other Eastern sections. The tree is small, spreading into a compact though irregular head of twiggy, slender branches. The yellow-green foliage, a foot long, of seven to nine short, stalked, lustrous leaflets, is lightened by a pale pubescence on petioles and leaf-linings. The same velvety down covers the new shoots. Summer and winter this sign never fails.

Red ash seeds are extremely long and slender, and have the most graceful outlines of all the darts that various ash trees bear. The heavy, round body has a wing twice its length by which the wind carries the seeds far away. Very gradually an ash tree launches its seeds. It is easy to understand why the family is so scattered through any woods, for the wind is the sower. The reddish bark of the twigs and trunk of this tree seems to be the justification for its name. Its brown wood is inferior to white ash.

The Green Ash

F. Pennsylvanica, Variety *lanceolata*, Sarg.

The green ash has narrower, shorter leaves than the parent species and usually more sharply saw-toothed margins. Instead of having pale linings, the leaflets are bright green on both surfaces. This is the ash tree of the almost treeless prairies from Dakota southward, where it not only lives, but flourishes as well as in its native habitat, the rich soil of stream banks farther east. Its range crosses the Rocky Mountains and reaches the slopes of the Wasatch Mountains in Utah. East of the Alleghanies the tree is little known. It is in the West that it is the dominant ash. It is one of the few important agencies which have turned the "Great American Desert" into a land of shady roads and comfortable, protected homesteads.

The Blue Ash

F. quadrangulata, Michx.

The blue ash has four-angled twigs, often winged at the corners with a thin plate of bark. The sap contains a substance that gives a blue dye when the inner bark is macerated in water. The tree reaches one hundred and twenty feet in height, above a slender trunk, and has small spreading branches that terminate in stout twigs, characteristically angled.

The tree is occasionally cultivated in parks and gardens in the Eastern states where it is a distinct addition to the list of handsome shade trees. It is hardy, quick of growth, and unusually free from the ills that beset trees. In the

forests it reaches its best estate on the limestone hills of the Big Smoky Mountains Its wood ranks with the best white ash and exceeds it in one particular; it is the most durable ash wood when exposed alternately to wet and dry conditions. It is used for vehicles, for flooring and for handles of tools especially pitchforks.

The Oregon Ash

F. Oregona, Nutt.

The Oregon ash follows the coast south from Puget Sound to San Francisco Bay, and from the western foothills of the Sierra Nevada to those of the mountains of southern California. In southwestern Oregon the tree reaches the height of eighty feet, with a trunk three to four feet in diameter. The stout branches form a broad crown where there is room, and the luxuriant foliage is wonderfully light in color, pale green above, with silvery pubescent leaf-linings. Of the five to seven leaflets, all are sessile or short-stalked, except the terminal one, which has a stem an inch long. All are oval and abruptly pointed, thick and firm in texture, turning yellow or russet brown in autumn. The lumber is counted equal to white ash and is one of the most valuable of deciduous timber trees in the western coast states.

A number of little ash trees, distinct in species from those described already, are native to limited sections of the country. All have the family traits by which they are readily recognized, if seed form, leaf form, and leaf arrangement are kept in mind. In the corner where Colorado, Nevada, and Utah meet, is an ash with its leaf reduced to a single leaflet, but the seeds are profusely borne to declare

the tree's name to any one who visits its restricted territory. In rich soil, three leaflets are occasionally developed.

The European Ash

F. Excelsior, Linn.

The *European ash* is the large timber ash from the Atlantic Coast of Europe to western Asia. The earliest writers have ranked its wood next to oak in usefulness. It was known as "the husbandman's tree." Its uses were listed at interminable length, for "ploughs, axle-trees, wheel-rings, harrows, balls . . . oars, blocks for pulleys, tenons and mortises, poles, spars, handles, and stocks for tools, spade trees, carts, ladders. . . . In short, so good and profitable is this tree that every prudent Lord of a Manor should employ one acre of ground with Ash to every twenty acres of other land, since in as many years it would be more worth than the land itself."

The saplings, cut when three to six years old, made excellent fork and spade handles on account of the toughness and pliability of their fibre. Crates for china were made of the branches. Steamed and bent, this wood lent itself to the making of hoops for barrels and kegs. The cutting off of the main trunk set the roots to sending up a forest of young shoots, ready for cutting again when they reached the size for walking-sticks and whip-stocks.

Quite independent of its lumber value, but possibly correlated with it, was the great reputation the ash tree achieved in the myths and superstitions of widely separated peoples. In south Europe, tradition declared that a race of brazen men sprung from the ash tree. In the North, the Norse mythology made *Igdrasil*, the ash, the "World

tree," from whose roots the whole race of men sprung. The roots of this mythological tree penetrated the earth to its lowest depths and its giant top supported the heavens. Wisdom and knowledge gushed from its base as from a fountain, and underneath were the abodes of the gods, giants, and the Fates. Superstitions of all kinds have come down with the language of different peoples, making the history of the ash tree a most interesting study.

A Chinese ash yields a valuable white wax which exudes from the bark of the twigs. *F. ornus*, Linn., native to south Europe and Asia Minor, exudes a waxy secretion from bark and leaves. This is the manna of commerce. Last but not least of the products of the ash tree are the curious and beautiful contortions of the grain found in "burls" on the trunks of old trees of many species. These warty excrescences are eagerly bought by special agents for cabinet-makers. Woodwork from these abnormal growths shows exquisitely waved lines when polished, as delicate as those in a banded agate. Fancy boxes, bowls, and other articles brought fancy prices when made of "ram's horn" or "fiddleback" ash, which often went under the trade name of green ebony. The black ash in America is particularly subject to contortions of the grain.

THE ELMS

Elms of sixteen distinct species are native to boreal and temperate regions of the Northern Hemisphere, with this single exception: western North America is without a representative. Europe has three species, two of which ex-

tend their range into eastern Asia and northern Africa. Southern and central Asia have their own species. Five are native to our Eastern states. Two European species are in cultivation in the North Atlantic states, especially in the neighborhood of Boston, where they are as familiar as the native species, in street planting.

Elm trees are valuable for shade and for lumber; their wood is hard, heavy, tough, pale in color, often difficult to split. The trees are distinguished from others by their simple, unsymmetrical, strong-ribbed leaves, saw-toothed, short-stalked, always unequal and often oblique at the base of the blade. The flowers, usually perfect, are inconspicuous, and the seeds are flat, entirely surrounded by a thin papery wing, that forms two hooks at the tip. Wind-carried, these seeds have had much to do with the wide distribution of elms.

The White Elm

Ulmus Americana, Linn.

The white or American elm is widely known as a tall, graceful wide-spreading tree, usually of symmetrical, vase shape, with slender limbs and drooping twigs. (*See illustration, page 215.*) It has the rough furrowed bark characteristic of the genus, dark or light gray, with paler branches and red-brown twigs. The leaves are alternate, two to six inches long, broadest near the abruptly pointed apex. Distinctly one-sided at the tapering base, the leaves have a fashion of arranging themselves in a flat spray so as to present almost a continuous leaf area to the sun. One spray overlaps another,

and leaves varying in size fit in to fill every little corner to which sunlight comes. This "leaf mosaic" is not confined to elms alone. It is especially noticeable on the southern border of any dense wood.

Winter offers the best opportunity for the study of tree forms. Our common elm shows at least five different patterns. The first is the "vase form," the commonest and most beautiful. This is best realized by old trees which have had plenty of room. In it the branches spread gradually upward at first but at a considerable height sweep boldly out forming a broad, rounded, or flattened head. Second is the "plume form," in which two or three main limbs rise to a great height before branching, and then break into feathery spray. Trees crowded in woods are likely to take this form. Third, the "oak tree form" shows a horizontal habit of branching, and an angularity of limbs usually more noticeable among oaks, Fourth, the "weeping willow form," where trees have short trunks, from which the branches curve rapidly outward and end in long, drooping branchlets. Fifth is the "feathered elm," marked by a fringe of short twigs which outline the trunk and limbs. This "feathering" is caused by the late development of latent buds. It may occur in any of the tree types just mentioned, but it is more noticeable in individuals of the plume form.

The American elm is very familiar for it grows everywhere east of the Rocky Mountains. Not to know this tree is a mark of indifference and ignorance. No village of any pride but plants it freely as a street tree. It is hardy and cheerful, reflecting the indomitable spirit of the pioneer, whom it accompanied by seed and sapling from the Eastern states into the treeless territories of the

Middle West. With him the tree seized the land and made it yield a living. Elms, which have outlived the cottonwoods and willows, are not so large yet as the patriarchal trees in old New-England villages, yet time alone is needed to match, in the valley of the Missouri, the elms in the valley of the Connecticut.

I think, with due appreciation of its summer luxuriance of foliage, and the grace and strength of the elm's framework in winter, that the moment of greatest charm in the life of a roadside elm comes in the first warm days of late March. The brown buds on the sides of the twigs are swelling and a flush of purple overspreads the tree, while snow still covers the ground. A tremendous "fall of leaves" ensues, for the tiny bud scales that enclose the elm flowers are but leaves in miniature. The elms are in blossom! Each flower of each cluster has a calyx with scalloped edges, and a fringe of four to nine stamens hanging far out and surrounding the central solitary ovary. The color is in the yellow anthers and the dark red calyx lobes.

Speedily, the stamens shrivel and pale green pendants, which are the seeds, cluster upon the twigs. Winged for flight, these ripen and are scattered before the leaves are fairly open, and the growth of the season's shoots begins. Only the pussy willow, the quaking asp, and the earliest maples bloom as early as the elm. How much they have missed, who never saw an elm tree in blossom!

The hubs of the "one-hoss shay" were of "ellum," its interlacing fibres peculiarly fitting this wood for indestructibility. Saddle trees, boat timbers, cooperage, and flooring employ it in quantities. It is also used for flumes and piles, for it resists decay on exposure to water.

The Slippery Elm

U. fulva, Michx.

The slippery elm is also known as the red elm and moose elm, because its wood is red and moose are fond of browsing its young shoots. In regions where moose are rarely seen, it is the small boy who browses and often utterly destroys every specimen of this valuable tree. Under the bark of young shoots a sweet substance is found, which gives the tree its common name. What man lives who in the heydey of youth has not had the spring craze for slippery elm bark, as surely as he had the fever for kite-flying and playing marbles? The trees in every fence row show the wounds of jack-knives; stripping the bark, the boys scrape from its inner surface the thick, fragrant mucilaginous *cambium*—a delectable substance that allays both hunger and thirst. Fortunately the bark of the limbs supplies the demand; many a veteran tree still suffers the pollarding process, serving one generation of schoolboys after another.

The inner bark, dried and ground and mixed with milk, forms a valuable food for invalids. Poultices of slippery elm bark relieve throat and chest ailments. Fevers and acute inflammatory disorders are treated with the same bark, which has passed from the list of mere home remedies to an established place on the apothecary's shelf.

How shall we tell a slippery elm tree from the American elm? By its leaf in summer. The roughness of the foliage is one of its striking characteristics. Crumple a leaf, and its surfaces grate harshly, for they are covered with stiff, tubercular hairs. The leaves are larger, often reaching

seven inches in length. There is a reddish or tawny pubescence on all young shoots, and especially on the bud scales in winter. The tree itself, in winter or summer, is much more coarse than its cousin. It is also unsymmetrical in habit, each limb striking out for itself. Very often one meets a tree quite as one-sided in form as its leaf, and this without any apparent reason. But given a chance to grow without mutilation, the slippery elm attains a height of seventy feet, forming a broad, open head, in comparatively few years. It is well worth planting for its lumber and for shade.

The Rock Elm

U. Thomasi, Sarg.

The rock elm or cork elm chooses dry, gravelly upland and low heavy clay soil, on rocky slopes and river cliffs, from Ontario and New Hampshire westward through northern New York, southern Michigan to Nebraska and Missouri. It is more abundant and of largest size in Ontario and in the southern peninsula of Michigan.

Its leaf is small, thick, and firm, dark green, and turns to brilliant yellow in the autumn. Its flowers and fruits are borne in racemes. At any season, one knows this cork elm by the shaggy bark on its stout limbs that make the tree resemble a bur oak. "Rock elm" and "hickory elm" are names that refer to the hardness of the wood. The wheelwright counts it the best of all elms. Compact, with interlacing fibres, there are spring, strength, and toughness in this wood which adapt it for bridge timbers, heavy agricultural implements, wheel stocks, sills, and axe-

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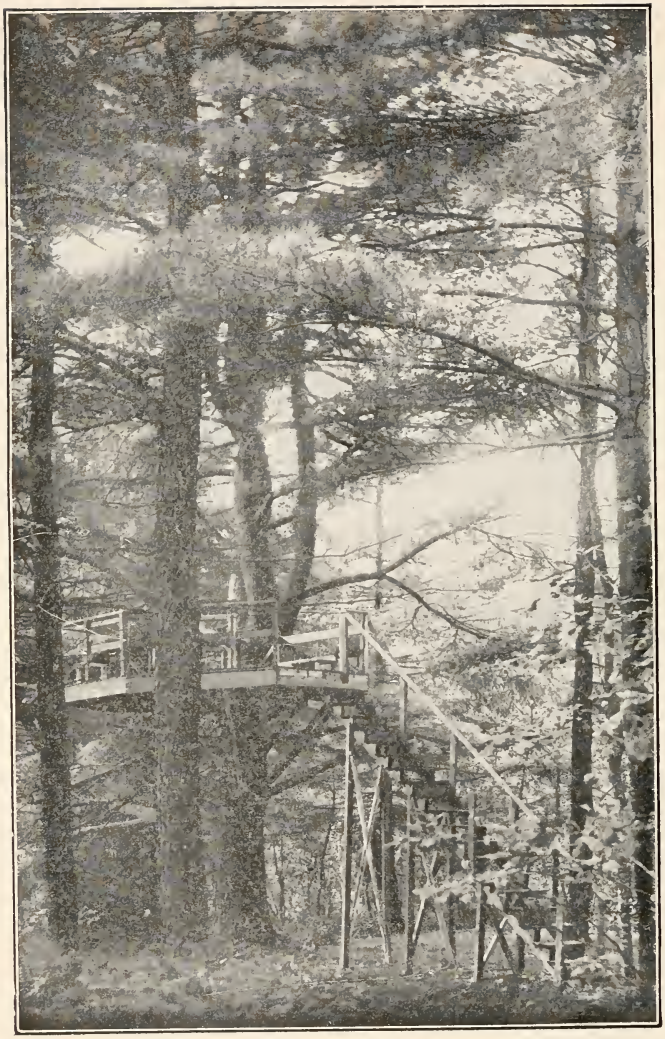
THE WHITE ASH

Winter buds

Pistillate flowers

Staminate flowers



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A GROUP OF WHITE PINES

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LEAVES AND CONES OF THE SHORTLEAF PINE

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AMERICAN ELM

handles. The name "cork elm" refers to the corky bark which runs out in winged ridges, even to the twigs.

The Winged Elm

U. alata, Michx.

The winged elm, or wahoo, is dainty and small, its leaves and the two thin corky blades that arise on each twig befitting the smallest elm tree in the family. Despite its corky wings, it has none of the ruggedness of the cork elm, but is a pretty round-headed tree. It is distributed from Virginia to Florida and west to Illinois and Texas. "Mountain elm" and "small-leaved elm" are local names. "Wahoo" is local also, belonging chiefly to the South. Even the little seed of this tree is long and slender, its wing prolonged into two incurving hooks.

The English Elm

U. campestris, Linn.

The English elm is often seen in the Eastern states, planted with the American elm in parks and streets, where the two species contrast strikingly. The English tree looks stocky, the American airily graceful. One stands heavily upon its heels, the other on tiptoe. One has a compact, pyramidal or oblong head, the other a loose open one. In October the superb English elms on Boston Common are still bright green, while their American cousins have passed into "the sere and yellow leaf."

The Scotch Elm

U. montana, Linn.

The Scotch or wych elm is planted freely in parks and private grounds. It is a medium-sized tree of rather more strict habit of growth than the American elm. Before the leaves open the tree often looks bright green from a distance. This appearance is due to the winged seeds which are exceptionally large and crowd the twig in great rosettes.

One horticultural variety of this species is the weeping form known as the Camperdown elm, which arches its limbs downward on all sides, forming when full-grown a natural arbor. One often sees this tree planted on lawns of limited extent, and so near the street as to render utterly absurd its invitation to privacy. To serve that reasonable and delightful end, the tree should be planted in a retired corner of one's grounds, where an afternoon siesta may be enjoyed undisturbed.

PART VIII

THE CONE-BEARING EVERGREENS

The Pines—The Spruces—The Firs—The Douglas Spruce—The Hemlocks—The Sequoias—The Abror-vitæs—The Incense Cedar—The Cypresses—The Junipers—The Larches, or Tamaracks

The cone-bearers, or conifers, are a distinct race that we commonly call evergreens. They include pines, hemlocks, spruces, firs, sequoias, cypresses, cedars, and junipers. Besides these, the tamaracks and the bald cypress must be included, although their leaves are shed in the autumn. The term "evergreen" applies equally well to magnolias, laurels, and many oaks. Birches and alders and magnolias bear cone-like fruits. Notwithstanding such exceptions, the cone-bearing trees are mostly evergreen, and their family traits are so strongly marked that even the beginner in tree study eliminates the exceptional instances early in his studies.

The pines and their relatives in the coniferous group are an ancient race, composed of proud old "first families." Along the shores of the Silurian seas they stood up, straight and tall, their only companions that stood erect, the giant horse-tails and tree ferns. This was long before modern tree families had any existence. There were no broad-

leaved trees. In the coal measures are found the mummied remains of these prehistoric conifers. The cycads in the Everglades of Florida are some of their surviving representatives. These are facing extinction, and the conifers, too, are declining. They had reached their prime as a race when the broad-leaved trees appeared upon the earth. The vigor of the new race enabled it to seize the richest, well-watered regions. They drove the conifers to seek the swamps, the exposed seacoasts, the barren and rocky mountain slopes. Man has ruthlessly destroyed for timber the coniferous forests of this country and much of the territory denuded by the axe is either devoted to agriculture or has been seized by broad-leaved species of trees, more tenacious of life and with seeds more quick and sure to germinate than those of the conifers. The time is not far distant, geologically speaking, when this ancient and declining family of trees will exist only as man fosters it by cultivation.

The conifers have resinous wood, with stiff, needle-like or scale-like leaves, and inconspicuous flowers of two sorts, borne in clusters like catkins. The pistillate catkin matures into a woody cone made of overlapping scales attached to a central stem. On each scale are borne one or more winged seeds.

The one character which is constant in the whole coniferous group and sets it apart from the rest of the plant kingdom, is expressed in the name *Gymnosperm*, applied to this botanical grand division. It means "naked seed." There is no ovary in the flower. The naked ovules are borne on the scales of the fertile spike or catkin, which is held apart and erect in blossoming time. They are pollinated by the wind, which sifts them with golden pollen

dust, abundant in the staminate catkins clustered on the same tree. Contact of pollen grains and naked ovules is followed by their coalescence—the "setting of seeds."

The distinguishing trait of the higher plants that form the grand division known as *Angiosperms*, is that the ovules are borne in a closed ovary, and the pollen lodges on the end of a stigma. "Pollen tubes" grow down through the long style, finally reach the hidden ovule, and seed is set. This complicated process is found in the majority of flowers one studies in botany classes. Gymnosperms, and the still lower groups of flowerless ferns and mosses, are merely glanced at by amateur botanists. The more primitive plant forms are too difficult for beginners.

The habit of the conifers is a character upon which we may depend. With rare exceptions, there is a central shaft, "the leader," and short horizontal branches in whorls forming platforms. The side branches, also whorled, are generally flattened into a horizontal spray. The leaves are narrow, needle-like, or scale-like, and waxy or resinous. The tough fibre of the wood enables the conifers to resist damage by wind and by ice. Snowflakes sift to the ground instead of accumulating upon the branches and breaking them by their cumulative weight. The wind, which pollinated the fertile flowers of coniferous forests long before nectar-gathering insects came upon the earth, is the harvester of their seeds. It scatters them far and wide; each seed has a wing that adapts it to long journeys in front of a gale.

The resinous sap that courses through the veins of coniferous wood seals up the bark, leaves, and cones against the invasion of enemies, and acts as an antiseptic dressing for wounds. Without these special adaptations to a life of

hardship, the conifers would never have held their own as they have done. They inhabit regions where conditions discourage all but a few of the broad-leaved trees.

THE PINES

In a forest of needle-leaved evergreens it is perfectly easy to distinguish the pines by their leaves. Look along the twigs and you will find the needles arranged in bundles, with a papery, enclosing sheath at the base. Follow farther back and these sheaths are missing, but on long stretches between the growing tip and the leafless part of the branch the characteristic sheathed needle-bundles declare this evergreen to be a pine. No other conifer has this trait, no pine grows but shows it every day in the year.

One half of the eighty known species of pines grow in North America. Pure forests of great extent are found in the Southern states, in the Great Lakes region, and on the mountain slopes in the western and northern parts of the continent. Smaller areas occur in the Eastern states. Very soon these forests must be spoken of in the past tense, for a century of destructive lumbering has almost cleared the Northeast of pine timber, and though the exploitation of the pine forests of the South and about the Great Lakes came later, as population increased in the Middle West, the work has progressed much more rapidly. The idea of forest conservation, crystallized into federal law by popular demand, has come too late to save from wasteful exploitation the superb pine forests west of the Rockies. Yet thousands of acres of forests are now under government

control and here a great object lesson in rational methods of forest maintenance is being given. The pineries of the future depend upon the success of methods there employed.

The uses of pines are not all counted in terms of the lumberman. There are pines for every situation, soil, and climate. On low seaboard plains they come down to the highwater mark. They wade into inundated swamps and climb to the timber line on arid, rocky mountainsides. The bravest species go out into the desert. Almost as brave are those which survive the smoke and dust of cities like Pittsburg and St. Louis, though theirs is a losing fight with sulphurous fumes and cramped root space in the smoky town. As shelter belts, as windbreaks, as shade and ornamental trees, there are pines in cultivation in all parts of the country, their winter usefulness and beauty making them universally the choice of home-makers, rich and poor.

By-products of pine wood are chiefly turpentine, pitch, resin, and oil, derived from the resinous sap. "Naval stores" these products are called, for their consumption is greatest in shipyards. Turpentine is extensively used in the arts and industries. If the Southern pine forests are allowed to dwindle, the deficit in lumber will not affect world commerce as disastrously as the cutting off of the naval stores production.

The lumberman's division of the pines is a convenient one. "Soft pines" have soft, light wood, not heavily impregnated with resin. It is the delight of wood-workers. "Hard pines" have heavy, dark-colored wood, full of resin, which is a nuisance to the carpenter, because it "gums up" his tools. The one little sign enables us to distinguish

hard and soft pines without examination of the wood. Soft pines shed the papery sheath of their leaf bundles before the leaves themselves begin to fall. Hard pines retain the leaf sheath until the leaves are shed. A glance at any leafy pine branch will enable us to determine to which of the two classes a given tree belongs.

The Soft Pines

The outward and visible sign of a soft pine is the loose, deciduous sheath of its leaf bundles. The scales of its cones are usually unarmed with horns or prickles. The wood is soft, light colored, close-grained. The number of leaves in a bundle is the principal key to the species.

The White Pine

Pinus Strobus, Linn.

The white pine (*see illustrations, pages 214-215*) is the only pine east of the Rocky Mountains that bears its leaves in bundles of five. This semi-decimal plan is found in three western soft pines and two western hard pines; but in the East, a native tree with needles in fives, leaves no doubt as to its name. From a distance this plan of five can be seen in the five branches that form a platform each year around the central shaft.

Study a sapling pine and you see in its vigorous young growth the fulfillment of nature's plan, before storms have broken any of the branches and changed the mathematics of the pattern. Stroke the flexible, soft leaves that sway graceful and lithe in the wind. If it is spring, note that

the terminal bud has pushed out, and around it five-clustered buds are forming a circle of shoots. In autumn, after the season's growth is finished, each twig ends in a single bud, with a whorl of five buds around it. From the ground upward, count the platforms of branches. Each whorl of five marks a year in the tree's growth. The terminal bud carries the height a foot or two upward, and its surrounding five buds grow in the horizontal plane, forming the last and smallest platform of leafy shoots. Each branch is a year younger than the shoot that bears it. Note throughout this little tree the plan of five, from leaf cluster to largest branch.

Now go to the largest white pine in your neighborhood, study the plan of five in this tree, and find out the reason for any failures. Notice the conflict between the branches in the close platforms. Find branches where this conflict is in progress. Pick out the winner. Read the age of the tree by the platforms of branches on the trunk.

No evergreen is more beautiful than a white pine grown in rich soil in a situation sufficiently sheltered to defend its supple branches from breakage by severe winds. Its soft, plume-like twigs are dark blue-green, with pale lines lining each individual leaf. The young shoots are yellowish green, and they lighten in a wonderful manner the sombre coloring of the older foliage. At the bases of the new shoots cluster the staminate catkins, in early June. Yellow and becoming loose and pendulous as the wind shakes them, they are soon empty of their abundant pollen, which drifts like gold dust and fills the air. Among the youngest leaves, toward the end of the shoot, the purplish rosy lips of the erect pistillate cone-flowers catch the dust from neighbor trees, and their naked ovules absorb it

and set seed. Close shut are the lips again, against any other invasion, while these ovules mature. We shall find them standing erect until autumn, but next season they hang down with their added weight, and at the end of the second summer the scales change from green to brown, open and give their ripe winged seeds to the wind for distribution. Because the tree is biennial-fruited, it always carries two sizes of cones. The large ones are one year older than the small ones. Ripe cones are five to ten inches long, with thin, broad, unarmed scales, squarish at the tips.

The most hopeful phase of the white pine problem to-day is the fact that new forests are coming up naturally where the early lumbering deforested great tracts in the Eastern states. Careful forestry improves upon nature's method, and so the pines are being restored on land unfit for agricultural crops. White pine is one of the most profitable timber crops to plant at the present time.

The Mountain Pine

P. monticola, D. Don.

The mountain pine is scattered through mountain forests from the Columbia River Basin in British Columbia to Vancouver Island, along the western slopes of the Rocky Mountains to northern Montana and Idaho, and south along the Sierra Nevada and Cascade ranges in Washington and Oregon, well into California. From the bottom lands of streams, where it is most abundant and reaches a height of one hundred to one hundred and fifty feet, and a trunk diameter of five to eight feet, it climbs to elevations of eight to ten thousand feet on the California Sierras.

The bark of young trees and on the branches of old ones is smooth and pale-gray. The leaves, five in the bundles, range from one to four inches in length, stiff, blue-green, whitened by two to six stripes on the inner side. The cones are twelve to eighteen inches long, with thickened, pointed scales ending in an abrupt beak. The larger cone, denser, stiffer foliage, and the white bark make this white pine of the western mountains a great contrast to the Eastern white pine.

Unlike many trees whose size diminishes with increase in altitude, this white pine grows to majestic size at altitudes of nearly two miles, its noble figure more striking and impressive because of the dwindling size of its companions on the mountain-sides. The lumberman looks with despair upon these giant white pines, quite out of his reach.

In the Arnold Arboretum in Boston a fine seedling specimen of this western silver pine fruited when but twelve feet high, and proves vigorous and altogether happy in this absolutely changed climatic environment. In Europe the same success attends the cultivation of these trees, which have become very popular in parks and private grounds. Their introduction into our Eastern states can now be assured of success.

The Sugar Pine

P. Lambertiana, Dougl.

The sugar pine (*see illustration, page 231*) belongs in the class with those tree giants, the sequoias, with which it grows in the mountain forests of Oregon and California. John Muir calls it "the largest, noblest, and most beautiful

of all the pine trees in the world." Trees two hundred feet high, with trunk diameter of six to eight feet, are not uncommon. The maximum given by Sargent is twelve feet across the stump. The head of a sugar pine is rounded and broad, with pendulous branches, tufted with stout, dark green leaves, three to four inches long. The cones are the largest known, reaching eighteen inches in length, rarely longer. The black or dark brown seeds are one to five inches long, including the flat, blunt wings. Indians, bears, and squirrels gather the abundant harvest of these cones, which are rich in nutriment and pleasant to the taste. Crystals of sugar form white masses like rock candy, but with a taste of maple sugar, wherever a break in the bark of a sugar pine permits the escape of the sweet sap. This gives the tree its name. No other pine has sap with such a noticeable sugar content.

Fortunately, these gigantic soft pines belong to the high Sierras and do not go down to the sea, where lumbermen could sacrifice them without effort. Nature has fenced them in by many barriers, and the government, by reservation in national parks, insures the preservation of some of the finest sugar pine groves, for the use and inspiration of all the people.

A visit to Yosemite is the experience of a lifetime to any American. Here grow the most gigantic trees in the world, and the sugar pines are nobler even than the giant "big trees," for the latter are often decrepit, while the sugar pines are hale and youthful by comparison. Leaving behind the scrawny gray digger pines on the foothills, the traveler enters the belt of the yellow pines, on the higher elevations, and passing these he comes to the grand sugar pines along the highest level of the stage road that leads

into the National Park. The road is no wider than the broad stumps of sugar pines, scattered here and there. The standing trees amaze one with their height and girth.

It is impossible to shake off the impression that some magic has put magnifiers in our eyes; for trees, beetling cliffs, and rushing cataracts are bigger than their counterparts in other regions of the world far-famed for their scenery. The sugar pine trunks seem like great builded columns, too large for any real tree to grow, and the "big trees" in the Mariposa Grove intensify this impression of unreality. In a day or two the traveler becomes accustomed to his surroundings. He goes out of the Park and down into the world of men and affairs, his soul enlarged, his life enriched by an experience he can never quite forget. He is a bigger, better man for his brief association with Nature in her noblest manifestations.

The wood of the sugar pine is soft, golden, satiny, fragrant, inviting the woodworker through every one of his senses. A single tree often yields five thousand dollars' worth of marketable lumber, the finest, straight-grained soft pine in the world.

The shame of the century is the wanton destruction of sugar pine trees by vagrant shingle-makers and thieving mill-owners, who despoiled the grandest trunks of their choicest wood, wastefully leaving the bulk to cumber the ground and invite forest fires. Late and slowly, but surely also is the popular mind awakening to the fact that forests belong to the nation and should be conserved and maintained for the whole people—not wasted for the temporary enrichment of private owners, as forest wealth has been squandered in past years.

Rocky Mountain White Pine

P. flexilis, James

The Rocky Mountain white pine inhabits mountain slopes from Alberta to Mexico, including the Sierra Nevada range. In northern New Mexico and Arizona it occasionally reaches eighty feet in height, but ordinarily does not exceed fifty. Its rounded dome, as broad as an oak, bravely dares the wind on exposed cliffs, and crouches as a stunted shrub at altitudes of twelve thousand feet. The "limber pine" it is called, from the toughness of its fibre, which alone enables its long limbs to sustain the whipping they get. The leaves form thick, beautiful dark-green tufts, which are not shed until the fifth or sixth year. The cones are three to ten inches long, purplish; scales rounded, abruptly beaked at the apex; narrow wings entirely surround the seeds, which fall in September.

This is the lumber pine of the semi-arid ranges of "The Great American Desert"; the main dependence of builders, too, on the eastern slopes of the Rockies in Montana.

The White-bark Pine

P. albicaulis, Engelm.

The white-bark pine is a rippled, gnarled, squatting tree, whose matted branches, cumbered with needles and snow, make a platform on which the hardy mountain-climber may walk with safety in midwinter. It offers him a springy mattress for his bed, as well. The trunk is covered with snowy bark that glistens like the ice-

mantle that lies on the treeless mountain-side just above the timber line.

From a twelve-thousand-foot elevation on the Rocky Mountains, in British Columbia and south to the Yellowstone, the tree clambers down to the five-thousand-foot line, where it sometimes attains forty feet in height; its dark green, rigid leaves persist from five to eight years, always five in a bundle, and never more than two and a half inches long. The cones, horny-tipped, dark purple, one to three inches long, are ripe in August; the large sweet seeds are gathered and eaten by Indians. In California the tree's range extends into the San Bernardino Mountains.

THE TWO "FOXTAIL" PINES

Two Western pines are distinguished by the common name "foxtail pine," because the leaves are crowded on the ends of bare branchlets. *P. Balfouriana*, M. Murr., has stiff, stout dark green leaves with pale linings. The tree is wonderfully picturesque when old, with an open irregular pyramid, on the higher foothills of the California mountains, or crouching as an aged straggling shrub at the timber-line. Its cones are elongated, the scales thickened and minutely spiny at tip.

The second five-leaved foxtail pine is *P. aristata*, Engelm., also called the "prickle-cone pine," from the curving spines that arm the scales of the purplish brown fruits. This is a bushy tree, with sprawling lower branches and upper ones that stand erect and are usually much longer, giving the tree a strange irregularity of form. The leaves are short and crowded in terminal brushes. From a stocky tree forty feet high, to a shrub at the timber line, this tree

is found near the limit of tree growth, from the outer ranges of the mountains of Colorado to those of southern Utah, Nevada, northern Arizona and southeastern California. In Eastern parks it is occasionally seen as a shrubby pine with unusually interesting, artistic cones.

THE NUT PINES

The nut pines, four in number, supply Indians and Mexicans of the Southwest with a store of food in the autumn, for the seeds are large and rich in oils and they have keeping qualities that permit their hoarding for winter. The four-leaved *P. quadrifolia.*, Sudw., scattered over the mountains of southern and Lower California, has four leaves in a cluster, as a rule. A desert tree, its foliage is pale gray-green, harmonizing with the arid mesas and low mountain slopes, where it is found. The cones are small with few scales, but the nut is five-eighths of an inch long and very rich.

P. cembroides, Zucc., with two to three leaves, is the "piñon," that covers the upper slopes of Arizona mountains with open forests fifteen to twenty feet high. The leaves are one to two inches long, dark green with pale lines, the branchlets orange-colored and matted with hairs. The large nuts are very oily, and so abundant in the mountains of northern Mexico that they are sold in large quantities in every town.

The piñon (*P. edulis*, Engelm.) ranges from the eastern foothills of the Colorado Rockies to western Texas and westward to the eastern borders of Utah, southwestern Wyoming, central Arizona and on into Mexico, often forming extensive open forests, and reaching an elevation

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EASTERN RED CEDARS AND HICKORY

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THE SUGAR PINE

"The largest, noblest, and most beautiful of all pine trees in the world"

of seven thousand feet. Short, stiff leaves in clusters of two or three, dark green, ridged, stout, often persist for eight or nine years. The tree is a broad compact pyramid; in age, dense, round-topped, with stout branchlets and abundant globose cones. Each scale covers two seeds, wingless, about the size of honey locust seeds, oily, sweet, nutritious and of delicious flavor. This is the pine nut *par excellence*, whose newest market is among confectioners and fancy grocers throughout the states.

The one-leaved nut pine (*P. monophylla*, Torr.), spreads like an old apple tree, and forms a low, round-topped, picturesque head, its lower limbs drooping to the ground. The reduction of the leaves in the clusters to lowest terms, gives the tree a starved look, and the eighteen or twenty rows of pale stomates on each leaf give the tree-top a ghostly pallor. The vigor of the tree is expressed in its abundant fruit, short, oblong, one to two inches in length, with rich plump brown seeds upon which the Indians of Nevada and California have long depended. The wood supplies fuel and charcoal for smelters; and this stunted tree, rarely over twenty feet in height, forms nut orchards for the aborigines and the scattered population of whatever race, between altitudes of five and seven thousand feet. From the western slopes of the Wasatch Mountains of Utah, it ranges to the eastern slopes of the southern Sierra Nevada, to their western slopes at the head waters of King's River, and southward to northern Arizona and to the mountains of southern California.

John Muir says:

"It is the commonest tree of the short mountain ranges of the Great Basin. Tens of thousands of acres are cov-

ered with it, forming bountiful orchards for the red man. Being so low and accessible, the cones are easily beaten off with poles, and the nuts are procured by roasting until the scales open. To the tribes of the desert and sage plains these seeds are the staff of life. They are eaten either raw or parched, or in the form of mush, or cakes, after being pounded into meal. The time of nut harvest is the merriest time of the year. An industrious, squirrelish family can gather fifty or sixty bushels in a single month before the snow comes, and then their bread for the winter is sure."

THE PITCH PINES

Pitch pines have usually heavy coarse-grained, dark-colored wood, rich in resin—a nuisance to the carpenter. The leaf-bundles have persistent sheaths. The cone scales are thick and usually armed. "Hard pine" is a carpenter's synonym. The group includes some of the most valuable timber trees in American forests.

The Longleaf Pine

P. palustris, Mill.

The longleaf pine is preëminent in importance in the lumber trade and in the production of naval stores. It stretches in a belt about one hundred and twenty-five miles wide, somewhat back from the coast, all the way from Virginia to Tampa Bay and west to the Mississippi River. Isolated forests are scattered in northern Alabama, Louisiana, and Texas.

The trees are tall, often exceeding one hundred feet in height; with trunks slender in proportion, rarely reaching three feet in diameter. The narrow, irregular head is formed of short stout twisted limbs on the upper third of

the trunk. The leaves are from twelve to eighteen inches long, forming dense tufts at the ends of the branches. Being flexible they droop and sway on the ends of erect branches like shining fountains, their emerald lightened by the silvery sheaths that invest each group of three.

Sapling longleaf pines have recently entered the market for Christmas greens in Northern cities. This threatens the renewal of longleaf forests that have fallen to the axe of the lumberman. Unless Federal restriction comes to the rescue, there is little hope of saving this young growth, for nothing can exceed in beauty a three-foot sapling of longleaf pine as a Christmas decoration.

The lumber of this species is the "Southern pine" of the builder. Heavy, strong, yellowish brown, durable, it has a tremendous vogue for flooring and the interior finish of buildings. It is used in the construction of railway cars. Its durability in contact with water accounts for its use in bridge-building, and for masts and spars of vessels. A great deal of this lumber is exported for use in European shipyards. It has replaced the dwindling supply of white pine for building purposes throughout the North, and the strong demand for it has been followed by lumbering of the most destructive and wasteful type, because the forests are owned privately.

In the early days the American colonists in Virginia tapped the longleaf pine, collected the resin from the bleeding wounds, and boiled it down for pitch and tar. These crude beginnings established an industry now known as the "orcharding" of the longleaf pine. After a century of wastefulness and wanton destruction of the trees, it has become patent to all that scientific methods must be resorted to in the production of turpentine and other pro-

ducts derived from the living trees. Otherwise the dwindling industry will soon come to an end.

Resin is the sap of the tree. The first problem is to draw it in a manner least wasteful of the product, and least dangerous to the life of the tree. The second process is the melting of the collected resin in a still and the drawing off of the volatile turpentine. What is left solidifies and is known as *rosin*.

"Boxing" the trees was the cutting of a grooved incision low on the trunk, with a hollow at the base of the vertical trough to hold the discharge of the bleeding sap-wood. Resin-gatherers visited the tapped trees and emptied the pockets into buckets by means of a ladle. They also scraped away the hardened sap and widened the wounds to induce the flow from new tissues. This method cost the life of the tree in two or three years, and it became a prey to disease and a menace to the whole forest, as fuel for fires accidentally started. Nowadays, all reasonable owners of longleaf pine have discarded the old-fashioned boxing and installed methods approved by the Department of Forestry.

Tar was formerly derived from the slow burning of wood in a clay-lined pit. The branches, roots and other lumber refuse, cut in small sizes were heaped in a compact mound and covered with sods and earth. Smoldering fires soon induced a flow of smoky tar, thick as molasses, in the bottom of the pit. In due time the flow ceased, the fires went out, and charcoal was the result of this slow burning. Removing the charcoal, the tar became available for various purposes; boiled until it lost its liquid character, it became tough sticky *pitch*. This primitive pit method of extracting tar and making charcoal has been abandoned wherever

intelligence governs the industry, and distillation processes have been installed.

The Shortleaf Pine

P. echinata, Mill.

The shortleaf pine ranks second to the longleaf in importance to the lumber industries of the East and South. It ranges from Staten Island, New York, to north Florida, and west through West Virginia, eastern Tennessee, southern Missouri, Louisiana and eastern Texas. It reaches its largest size and greatest abundance west of the Mississippi River, where great forests, practically untouched thirty years ago, have become the centre of the "yellow pine" industry, out of which vast fortunes have been made. The wood is preferred by builders, because it is less rich in resin, softer and therefore more easily worked. Young trees yield turpentine and pitch, and with the longleaf and the Cuban pine much forest growth has suffered destruction in the production of these commodities.

The slender tree equals the longleaf in height and bears its dark green leaves in clusters of twos and threes, scattered on short branches that form a narrow loose head. The pale green, stout branchlets are lightened by the silvery sheaths of the young leaves (*see illustrations, pages 214-215*) which are short only in comparison with the companion species, the longleaf. The cones are abundant; the seeds numerous, winged for flight, retaining their vitality longer than most pine seeds. The tree is less sensitive to injuries and has the propensity, unusual in the pine family, of throwing up suckers from the roots. In open competition, this pine will hold its own against the invasion of

other trees, if only allowed to do so. Much of the deforested territory, let alone, will cover itself with a ripe crop of shortleaf pine lumber in a hundred years.

The Cuban Pine

P. Caribaea, Morelet

The Cuban pine stands third in the triumvirate of lumber pines of the South. This is the "swamp pine" or "slash pine," found in the coast regions from South Carolina throughout Florida, and along the Gulf Coast to the Pearl River in Louisiana. It is a beautiful pine—tall, with dense crown of dark green leaves, in twos and threes, eight to twelve inches long, falling at the end of their second season, before they lose their brightness. A large part of the turpentine of commerce has been derived from these coast forests, as well as lumber, which takes its place in the Northern market with the longleaf and the shortleaf.

Natural reforestation has taken place in the Southeast, and a large part of the turpentine exported by Georgia and South Carolina to-day, is from second-growth Cuban pine, on land from which the lumber companies have stripped the virgin growth.

The Loblolly Pine

P. Taeda, Linn.

The loblolly or old field pine chooses land generally sterile and otherwise worthless. It grows in swamps along the Atlantic coast, from New Jersey through the Carolinas, and follows the Gulf from Tampa Bay into Texas. Inland, it is found from the Carolinas to Arkansas and

Louisiana. It has remarkable vitality of seed and seedlings, which do equally well on sterile uplands, on water-soaked ground, or where soil is light and sandy. It is very apt to take possession of land once cleared for agriculture. The young trees crowd together and grow with tremendous vigor the first years of their lives, successfully holding large tracts in pure forests. The limbs are short, thick, matted, forming a compact rounded head; the leaves slender, stiff, twisted, pale-green, six to nine inches long, in groups of threes. The wood is rich in resin, but differs greatly in quality with age and the fertility of the soil. "Rosemary pine" was heavy, hard, close-grained, with a thin rim of soft sap-wood. This famous lumber, preferred by shipbuilders of many countries for masts, grew in the virgin forest of the Carolinas. Giants were cut in the rich marsh lands back from the Sounds. But the small loblolly pine, grown on sandy soil, is but third-grade lumber, the sap-wood three times as thick as the heart-wood and exceedingly coarse-grained. One merit has recently been discovered in this lumber, that formerly blackened before it was seasoned, by the invasion of a fungous growth. It quickly absorbs creosote, which renders it immune from decay. It is used in the building of docks, cars, boats, and locally in house-building. Its wood makes a sharp, quick heat when dried. It is used in bakeries and brick kilns, and in charcoal-burning.

The Pitch Pine

P. rigida, Mill.

The pitch pine goes down to the very water's edge on the sand-dunes along the New-England Coast, and spreads on

worthless land from New Brunswick to Georgia and west to Ontario and Kentucky. Occasionally in cultivation the tree is symmetrical, and grows to considerable size. In the most favorable situations, however, it rarely exceeds fifty feet in height, with gnarled rough branches, oftenest irregular in form and becoming painfully grotesque with age. The persistence of its clustered black cones adds to the tree's ugliness; and the tufted, scant foliage has a sickly yellowish-green color when new, and becomes darker and twisted the second year. The cones are armed with stout thorns and often remain on the trees ten or twelve years. The knots, particularly, are rich in resin—the delight of camping parties. "Pine-knots" and "candlewood" are household necessities in regions where these trees are the prevailing species of pine.

Starved as is its existence, the pitch pine springs up with amazing vigor after a fire. Suckers are sent up about the roots of the fire-killed trees, and the wind scatters the seeds broadcast for a new crop. The chief merit of the tree is that it grows on worthless land, and holds with its gnarled roots the shifting sand-dunes of the New-England Coast better than any other tree.

The Gray Pine

P. divaricata, Sudw.

The gray pine goes farther north than any other pine, following the McKenzie River to the Arctic Circle. From Nova Scotia to the Athabasca River, it covers barren ground, reaching its greatest height, seventy feet, in pure forests north of Lake Superior. In Michigan it forms the "jack-pine plains" of the Lower Peninsula. As a rule it is

a crouching, sprawling tree, its twigs covered with scant short dingy leaves in twos, averaging an inch in length. The wood is a great boon to the regions this tree inhabits. It is light, soft, weak, and close-grained; used for posts, railroad ties, building material and fuel. Its seeds germinate better from cones that have been scorched by fire.

The Digger Pine

P. Sabiniana, Dougl.

The digger pine is a western California tree of the semi-arid foothill country. Gray-green, sparse foliage on the gnarled branches gives the tree a forlorn starved look, as it stands or crouches, singly or in scattered groups, along the gravelly sun-baked slopes. The great cones, six to ten inches long, fairly loading the branches, express most emphatically the vigor of the tree. The thickened scales protrude at a wide angle from the central core, and each bears a strong beak, triangular, flattened like a shark's tooth, but curved. The rich oily nuts, as big as lima beans, furnish a nourishing food to the Indians. The Digger tribe harvested these nuts, and the pioneer gave the tree the tribal name.

The Western Pitch Pine

P. Coulteri, D. Don.

The Western pitch pine, most abundant in the San Bernardino and San Jacinto Mountains, at elevations of about a mile above the sea, has cones not unlike those of the digger pine, in the armament of their scales. These are notable by being the heaviest fruits borne by

any pine tree. Occasionally they exceed fifteen inches in length and weigh eight pounds. The seeds are one-half an inch in length, not counting the thin wing, which is often an inch long.

The leaves of this "big-cone" pine match the cones. They are stout, stiff, dark blue-green, six to sixteen inches long, three in a bundle, which has a sheath an inch or more in length. Crowded on the ends of the branches, these leaves would entitle this tree to qualify as a "fox-tail" pine, except for the fact that the foliage persists into the third and fourth year, which clothes the branches far back toward the trunk and gives the tree a luxuriant crown. The dry slopes and ridges of the Coast Ranges of California are beautified by small groves and scattered specimens of this striking and picturesque pine, so unlike its neighbors. Its wood is used only for fuel. In European countries this is a popular ornamental pine, planted chiefly for its great golden-brown cones.

The Knob-cone Pine

P. attenuata, Lemm.

The knob-cone pine inhabits the Coast Ranges from the San Bernardino Mountains northward on the western slopes of the Sierra Nevada and Cascade Mountains, into southwestern Oregon, where it forms pure forests over large areas, its altitude limit being four thousand feet. It is a tall slim tree of the hot dry fire-swept foothills, and it comes again with absolute certainty after forest fires. The clustered cones, three to six inches long, are amazingly hard and do not open at maturity, but wait for the death of the tree. Leaves three to seven inches

long, in clusters of three, firm, rigid, pale yellow or bluish green, cover the tree with a sparse thin foliage-mass; but the branches, new and old, are covered with cones, many of which are being swallowed up by the growth of wood on trunk and limb. Thirty or forty years these cones may hang, their seeds never released and never losing their vitality, until fire destroys the tree. Then the scales open and the winged seeds are scattered broadcast. They germinate and cover the deforested slopes with a crop of knob-cone pine saplings that soon claim all standing room and cover the scars of fire completely.

The Monterey Pine

P. radiata, D. Don.

The Monterey pine, like its companion, the Torrey pine, is restricted to a very narrow area. They grow together on Santa Rosa Island. At Point Pinos, south of Monterey Bay, this tree stands a hundred feet in height, with trunks occasionally five to six feet in diameter, its branches spreading into a round luxuriant, though narrow, head. From Pescadero to San Simeon Bay, in a narrow belt a few miles wide, and on the neighboring islands, this tree finds its limited natural range; but the horticulturist has noted the silvery sheen of its young growth and the rich bright green that never dulls in its foliage. Its quick growth and handsome form in cultivation make it the most desirable pine for park and shade planting in California. Indeed it is a favorite park tree north to Vancouver along the Coast. It has been introduced into Europe and is occasionally met in parks in the Southeastern states.

The Western Yellow Pine

P. ponderosa, Laws.

The Western yellow pine forms on the Colorado Plateau the most extensive pine forests of the American continent. Mountain slopes, high mesas, dry canyon sides, even swamps, if they occur at elevations above twenty-five hundred feet, furnish suitable habitats for this amazing species, in some of its varying forms. From British Columbia and the Black Hills it follows the mountains through the Coast Ranges, Sierras, and the Great Continental Divide, to the highlands of Texas and into Mexico, forming the most extensive pine forests in the world. All sorts of construction work draw upon this wonderful natural supply of timber, from the droughty western counties of the Dakotas, Nebraska and Texas, to the Pacific Coast.

The typical tree has thick plates of cinnamon-red bark, a massive trunk, five to eight feet in diameter, one hundred to two hundred feet high, with many short, thick, forked branches in a spire-like head. In arid regions the trunk is shorter and the head becomes broad and round-topped. Near the timber line and in swamps, the trees are stunted and the bark is nearly black.

The leaves of this pine tree are two or three in a bundle, stout, dark yellow-green, five to eleven inches long, deciduous during their third season. Their color has given the name to the species, for the wood is not yellow, but light red, with nearly white sap-wood.

On the way to the Yosemite, the traveler meets the yellow pine—splendid tracts of it—with the giant sugar

pine, in open park-like areas, where each individual tree has room to manifest the noble strength of its tall shaft.

The flowers appear in May, brightening the even color of the shiny leaves with their pink or brown staminate clusters two or three inches wide. The crimson pistillate cones hide at the ends of the branches, lengthening into fruits three to ten inches in length, and half as wide. Strong, re-curving tips, armed with slender prickles, are seen in the scales of the reddish-brown cones that fall soon after they spread and liberate the winged seeds. These are produced in abundance, are scattered widely by the wind, and accomplish the renewal of these mountain forests.

The bark is usually very thick at the bases of the trunks, reaching eighteen inches on the oldest trees. With this cloak wrapped about its living cambium, the yellow pine is able, better than most trees, to survive a sweeping forest fire.

Botanists have found *P. ponderosa* extremely variable, and they quarrel among themselves about species and variety, for the tree endures many climates, adapts itself to varying conditions and develops a type for each habitat and region. In old lake basins on the Sierra slopes, "variety *Jeffreyi*, Vasey," is the name given to the gigantic yellow pine, which there finds food and moisture in abundance and reaches its finest proportions and its greatest lumber value.

In the Rocky Mountains, "variety *scopulorum*, Engelm.," is the type. "But all its forms can be traced to a common origin and so the parent species stands; and despite man's devastating axe the yellow pine flourishes in the drenching rains and fog of the northern coast at the level of the sea, in the snow-laden blasts of the moun-

tains, in the white glaring sunshine of the interior plateaus and plains, and on the borders of mirage-haunted deserts, volcanoes, and lava beds,—waving its bright plumes in the hot winds undaunted, blooming every year for centuries, and tossing big ripe cones among the cinders and ashes of nature's hearths." (*John Muir.*)

The Scrub Pine

P. contorta, Loud.

The scrub pine is the humble parent of one of the splendid Western lumber pines, whose description comes under its varietal name. Down the coast of Alaska, usually in sphagnum bogs, on sand-dunes, in tide-pools and deep swamps to Cape Mendocino, the indomitable, altogether-admirable scrub pine holds its own against cold, salt air and biting arctic blasts. No matter how stunted, gnarly and round-shouldered these trees are, one thing they do, often when only a few inches high: *they bear cones,* and keep them for years; and each season add more. Up from the sea the scrub pine climbs, ascending the Coast Ranges and western slopes of the Cascade Mountains, changing its habit to a tree twenty to thirty feet tall with thick branches and dark red-brown bark, checked into oblong plates. Gummy exudations of this pitch pine make it peculiarly liable to running fires. Thousands of acres are destroyed every summer, but they seize the land again and soon cover it with the young growth. This happens because the burned trees drop their cones, which open and set free the seeds which have never lost their vitality.

In all the vast region over which this vagrant tree

swarms, it furnishes firewood and shelter. The pioneer blesses it, and a great multitude of wild things, both plant and animal, maintain their lives in comfort and security because of its protection.

The lodge-pole pine or tamarack pine is but a variety (*Murrayana*) of *P. contorta*, that grows in forests on both slopes of the Rocky Mountains of Montana and Wyoming, at elevations of from seven to eight thousand feet, and stretches away into British Columbia and Alaska, and southward to the San Jacinto Range. Between eight thousand and nine thousand five hundred feet in altitude, along the Sierra Nevada in California, it reaches its greatest size and beauty, and forms extensive dense forests. The young trees have very slender trunks, and often stand crowded together like wheat on the prairie. An average forest specimen is five inches in diameter, when thirty or forty feet in height. No wonder the Indian in Wyoming and Colorado called it "the lodge-pole pine," for their supple trunks fitted these trees, while yet saplings, to support the lodge he built.

Richer, moister ground nourishes this fortunate offspring of the scrub pine. The two-leaved foliage, usually about two inches long, wears a cheerful yellow-green, while the parent tree is dark and sombre, with leaves an inch in length. The hard, strong, brown wood of *contorta* contrasts strikingly with that of its variety, which is light yellow or nearly white—soft, weak, straight-grained and easily worked. Its abundance in regions where other timber is scarce, brings it into general use for construction work. It also furnishes railroad ties, mine timbers and fuel, with the minimum of labor, since trunks of proper sizes can easily be selected.

The Indians, whose food supply was always precarious, gathered branches and made a soft pulp of the inner bark, scraped out in the growing season. This they baked, after shaping it into huge cakes, in pit ovens built of stones, and heated for hours by burning in them loads of fire-wood. When the embers were burned out, the oven was cleaned and the cakes put in. Later they were smoked with a damp fire of moss, which preserved them indefinitely. "Hard bread" of this type provisioned the Indian's canoe on long trips. Inedible until boiled, it was a staple winter food at home and on long expeditions, among various tribes of the Northwest.

The Red Pine

P. resinosa, Ait.

The red pine, also called the "Norway pine" for no particular reason, is something of an anomaly. Its wood is soft like that of the white pine with which it grows, and though *resinosa* means "full of resin," it is not so rich as several other pitch pines. Its paired leaves and red bark reveal its kinship with the Scotch pine, a European species, very common in cultivation in America.

Seemingly intermediate between soft and hard pines, *P. resinosa* appeals to lumbermen and landscape gardeners because it embodies the good points of both classes. No handsomer species grows in the forests, from New Brunswick to Minnesota and south into Pennsylvania. The sturdy red trunk makes a bright color contrast with the broad symmetrical pyramid of boughs clothed in abundant foliage. The paired, needle-like leaves, dark green and shining, are six inches in length. The flowers are abund-

See page 259

See page 248

LEAVES AND CONES OF HEMLOCK (*left*) AND OF NORWAY SPRUCE (*right*)

See page 248

THE SPINY FOLIAGE AND FAST-CLINGING CONES
OF THE BLACK SPRUCE

ant and bright red, more showy than is ordinary in the pine family. Brown cones one to three inches long with thin unarmed scales, discharge their winged seeds in early autumn, but cling to the branches until the following summer.

The wood of red pine is pale red, light in weight, close-grained with yellowish or nearly white sap-wood. Logs a hundred feet and more in length used to be shipped out of Canadian woods to England. Singularly free from large knots and other blemishes, they made huge spars and masts of vessels, as well as piles for dockyards, bridges, etc. Other woods have proved more durable, and the largest red pine timber has been harvested. So its importance in the lumber trade has declined.

But in cultivation the red pine holds its own for its quick growth, its hardiness, its lusty vigor and its beauty of color contrasts. It grows on sterile ground exposed to the sea, forming groves of great beauty where other pines would languish and die. For shelter belts, inland, it is equally dependable, and as specimen trees in parks and gardens it has few equals. At no season of the year does it lose its fresh look of health. Young trees come readily from seed, and throughout their lives they are unusually free from injuries by insects and fungi.

THE SPRUCES

The distinguishing mark of spruce trees is the woody or horny projection on which the leaf is set. Look at the twigs of a tree which you think may be a fir or a spruce. Wherever the leaves have fallen, the spruce twig is rough-

ened by these spirally arranged leaf-brackets. Leaf-scars on a fir twig are level with the bark, leaving the twig smooth. Spruce twigs are always roughened, as described above.

Most spruce trees have distinctly four-angled leaves, sharp-pointed and distributed spirally around the shoot, not two-ranked like fir leaves. They are all pyramidal trees with flowers and fruits of the coniferous type. The cones are always pendent and there is an annual crop. The wood is soft, not conspicuously resinous, straight-grained and valuable as lumber.

The genus picea comprises eighteen species, seven of which belong to American forests. These include some of the most beautiful of coniferous trees.

The Norway Spruce

Picea excelsa, Link.

The Norway spruce (*see illustration, page 246*) is the commonest species in cultivation. It is extensively planted for wind-breaks, hedges and shelter belts, where its long lower arms rest on the ground and the upper limbs shingle over the lower ones, forming a thick leafy shelter against drifting snow and winds.

The Black Spruce

P. Mariana, B. S. & P.

The black spruce is a ragged, unkempt dingy tree, with short drooping branches, downy twigs, and stiff dark blue-green foliage, scarcely half an inch long. Its cones, least in size of all the spruce tribe, are about one inch long and

they remain on the branches for years (*See illustration, page 247*).

Rarely higher than fifty feet, these scraggly undersized spruces are ignored by horticulturists and lumbermen, but the wood-pulp man has taken them eagerly. The soft weak yellow wood, converted into paper, needs very little bleaching. From the far North the species covers large areas throughout Canada, choosing cold bogs and swamp borders, or well-drained bottom lands. In the United States it extends south along the mountains to Virginia and to central Wisconsin and Michigan.

The Red Spruce

P. rubens, Sarg.

The red spruce forms considerable forests from Newfoundland to North Carolina, following the mountains and growing best in well-drained upland soil. This Eastern spruce is more deserving of cultivation than the one just described, for its leaves, dark yellow-green and shining, make the tree cheerful-looking. The slender downy twigs are bright red, and there is a warm reddish tone in the brown bark. The winter buds are ruddy; the flowers purple; and the glossy cones, one to two inches long, change from purple to pale reddish brown before they mature and drop to pieces. Even in crowded forests this spruce keeps its lower limbs and looks hale and fresh by the prompt casting of its early ripening cones.

The pale red wood is peculiarly adapted for sounding-boards of musical instruments. It has been used locally in buildings, but of late the wood-pulp mills get most of this timber.

The Engelmann Spruce

P. Engelmanni, Engelm.

The Engelmann spruce is the white spruce of the Rocky Mountains and the Cascade Range of Washington and Oregon, which forms great forests on high mountain slopes from Montana and Idaho to New Mexico and Arizona. Always in damp places, this thin-barked beautiful tree is safest, from fire. The leaves are blue-green, soft and flexible but with sharp callous tips. The cones are about two inches long, their thin scales narrowing to the blunt tips. Each year a crop of seeds is cast and the cones fall. Running fires destroy the seed crop with the standing trees, making renewal of the species impossible in the burnt-over tracts. For this reason, this beautiful spruce tree is oftenest found on the higher altitudes, or where wet ground and banks of snow defend it from its arch enemy. The tree is satisfactory in cultivation, but never equal to the wild-forest specimens. The wood is used locally for building purposes, for fuel and charcoal.

The Blue Spruce

P. Parryana, Sarg.

The blue spruce well known in Eastern lawns as the "Colorado blue spruce," is a crisp-looking, handsome tree, broadly pyramidal, with rigid branches and stout horny-pointed leaves, blue-green to silvery white, exceeding an inch in length. At home on the mountains of Colorado, Utah and Wyoming, it reaches a hundred to a hundred and fifty feet in height and a trunk diameter of three feet, and

becomes thin and ragged at maturity. The same fate overtakes the trim little lawn trees, so perfect in color and symmetry for a few years.

Tideland Spruce

P. Sitchensis, Carr.

The tideland spruce is the most important lumber tree in Alaska. It inhabits the coast region from Cape Mendocino, in California, northward; and is abundant on wet, sandy and swampy soil. The conspicuous traits of this tree are its strongly buttressed trunk, one hundred to two hundred feet tall, often greatly swollen at the base; the graceful sweep of its wide low-spreading lower limbs; and the constant play of light and shadows in the tree-top, due to the lustrous sheen on the bright foliage. It is a magnificent tree, one of the largest and most beautiful of the Western conifers, indomitable in that it climbs from the sea-level to altitudes three thousand feet above, and follows the coast farther north than any other conifer.

THE FIRS

In a forest of evergreens the spire form, needle leaves, and some other traits belong to several families. To distinguish the firs from the spruces, which they closely resemble in form and foliage, notice the position of the cones. All fir trees hold their ripe cones erect. No other family with large cones has this striking characteristic. All the rest of the conifers have pendent cones, except the small-fruited cypresses and arbor-vitaes.

All fir trees belong to the genus *abies*, whose twenty-five species are distributed from the Far North to the highlands of tropical regions in both the Eastern and Western Hemispheres. All are tall pyramidal trees, with wide-spreading horizontal limbs bearing thick foliage masses, and with bark that contains vesicles full of resinous balsam. The branches grow in whorls and spread like fern fronds, covered for eight or nine years with the persistent leaves. Circular scars are left on the smooth branches when they fall.

The leaves are the distinguishing character of the genus when cones are lacking. They are usually flat, two-ranked on the twig, without stems, and blunt, or even notched at the tip. For these typical leaves one must look on the lower sterile branches of the tree, and back of the growing shoots, where leaves are apt to be crowded and immature. The cones are borne near the tops of the trees, and on these branches the leaves are often crowded and not two-ranked as they are below. The flowers of fir trees are abundant and showy, the staminate clusters appearing on the under sides of the platforms of foliage; the pistillate held erect on platforms higher up on the tree's spire. Always the flowers are borne on the shoots of the previous season. The cone fruits are cylindrical or ovoid, ripening in a single season and discharging their seeds at maturity. The stout tapering axis of the cone persists after seeds and scales have fallen.

The bark of fir trees is thin, smooth, and pale, with abundant resin vesicles, until the trees are well grown. As age advances the bark thickens and becomes deeply furrowed. The wood is generally pale, coarse-grained, and brittle.

The Balsam Fir

Abies balsamea, Mill.

The balsam fir is probably best known as the typical Christmas tree of the Northeastern states and the source of Canada balsam, used in laboratories and in medicine. Fresh leaves stuff the balsam pillows of summer visitors to the North Woods. In the lumber trade and in horticulture this fir tree cuts a sorry figure, for its wood is weak, coarse, and not durable, and in cultivation it is short-lived, and early loses its lower limbs.

Throughout New England, northward to Labrador, and southward along the mountains to southwestern Virginia, this tree may be known at a glance by its two-ranked, pale-lined leaves, lustrous and dark green above, one half to one and one half inches long, sometimes notched on twigs near the top of the tree. Rich dark purple cones, two to four inches long, with thin plain-margined, broad scales, stand erect, glistening with drops of balsam, on branches near the top of the tree. The same balsam exudes from bruises in the smooth bark. By piercing the white blisters and systematically wounding branch and trunk, the limpid balsam is made to flow freely, and is collected as a commercial enterprise in some parts of Canada. "Oil of fir" also is obtained from the bark.

The Balsam Fir

A. Fraseri, Poir.

This balsam fir, much more luxuriant in foliage, and worthier of cultivation as an ornamental tree, is native to

the Appalachian Mountains of southwestern Virginia, Tennessee and North Carolina. The purple cones are ornamented by pale yellow cut-toothed bracts that turn back over the edge of the plain scale. Limited in range, but forming forests between the limits of four and six thousand feet in altitude, this tree is confined to local uses as lumber and fuel.

All the other firs of America are Western, and among these are some of the tree giants of the world.

The Red Fir

A. magnifica, A. Murr.

The magnificent red fir is called by John Muir "the noblest of its race." In its splendid shaft that reaches two hundred and fifty feet in height, and a trunk diameter of seven feet, there is a symmetry and perfection of finish throughout that is achieved by no other tree. One above another in graduated lengths the branches spread in level collars, the oldest drooping on the ground, the rest horizontal, their framework always five main branches that carry luxuriant flat plumes of silvery needles. Each leaf is almost equally four-sided, ribbed above and below, with pale lines on all sides, so wide as to make the new growth silvery throughout the season. Later these leaves become blue-green, and persist for about ten years. Only on the lower side of the branch are the leaves two-ranked.

The bark of this fir tree is covered with dark brown scales, deeply divided into broad rounded ridges, broken by cross fissures when old. Out toward the tips of the

branches the bark is silvery white. In mid-June the flowers appear, the staminate in profuse clusters against the silvery leaf-linings, bright red, on the under sides of the platforms. It is a blind or stupid person who can travel in fir woods and fail to notice this wonderful flower pageant, that may be viewed by merely looking upward. The pistillate flowers, greenish yellow, tipped with pink, are out of sight as a rule, among the needles in the tree-tops. They ripen into tall cylindrical cones, six to eight inches long and half as wide, that fall to pieces at maturity, discharging their broad thin scales with the purple iridescent winged seeds.

Pure forests of this splendid fir tree are found in southern Oregon among the Cascade Mountains, between five and seven thousand feet above the sea. It is the commonest species in the forest belt of the Sierra Nevada, between elevations of six thousand and nine thousand feet. From northern California, it follows the western slope of the Sierra Nevada, climbing to ten thousand feet in its southernmost range. A variety, *Shastensis*, Lemm., is the red fir with bright yellow fringed bracts on its stout cones. This ornament upon its fruits seems to be the chief distinguishing character of the form which occurs with the parent species on the mountains in Oregon and northern California, and recurs in the southern Sierra Nevada.

The best defense of this superb red fir is the comparative worthlessness of its soft, weak wood. Coarse lumber for cheap buildings, packing cases and fuel makes the only demands upon it. In European parks it is successfully grown as an ornamental tree, and has proved hardy in eastern Massachusetts.

The Noble Fir

A. nobilis, Lindl.

The noble fir or red fir is another giant of the Northwest. On the western slopes of the Cascade Mountains of Washington and Oregon it reaches occasionally two hundred and fifty feet in height, differing from *magnifica* in being round-topped instead of pyramidal before maturity. Its red-brown wood, furrowed bark and the red staminate flowers justify its name. The twigs are red and velvety for four or five years. The leaves are deeply grooved above, rounded and obscurely ribbed on the lower surface, blue-green, often silvery through their first season, crowded and curved so that the tips point away from the end of the branch.

The oblong cylindrical cones, four to five inches long, are velvety, their scales covered by bracts, shaped and notched like a scallop shell, with a forward-pointing spine, exceeding the bract in length. Forests of this tree at elevations of twenty-five hundred to five thousand feet are found in Washington and northern Oregon, from which limited quantities of the brownish-red wood enter the lumber trade under the name of "larch."

The White Fir

A. grandis, Lindl.

The white fir is a striking figure, from its silvery lined, dark green foliage, its slender pyramidal form that reaches three hundred feet in height, and the vivid green of its mature cones that are destitute of ornament and

slenderly cylindrical. From Vancouver Island southward to Mendocino County in California, this tree is common from the sea level to an elevation of four thousand feet. Eastward it extends into Idaho, climbing to seven thousand feet, but choosing always moist soil in the neighborhood of streams. Various uses, woodenwares, packing cases, and fuel consume its soft, coarse wood to a limited extent. The delicate grace of its sweeping down-curving branches makes it one of the most beautiful of our Western firs. It grows rapidly, and is a favorite in European parks.

The White Fir

A. concolor, Lindl. and Gord.

This white fir is a giant of the Sierras, but a tree of medium height in the Rocky Mountains. Its leaves are often two to three inches long, very unusual for a fir tree, curving to an erect position, pale blue or silvery at first, becoming dull green at the end of two or three years.

On the California Sierras, this silver fir tree lifts its narrow spire two hundred and fifty feet toward the sky and waves great frondlike masses of foliage on pale gray branches. As a much smaller tree, it is found in the arid regions of the Great Basin and of southern New Mexico and Arizona, territory which no other fir tree invades. In gardens of Europe and of our Eastern states this is a favorite fir tree, often known as the "blue fir" and the "silver fir" from its pale bark and foliage, whose blue cast is not always permanent. Eastern nurseries obtain their best trees from seeds gathered in the Rocky Mountains.

THE DOUGLAS SPRUCE

The Douglas spruce (*Pseudotsuga mucronata*, Sudw.), ranks with the giant arbor-vitaes, firs, and sequoias in the forests of the Pacific Coast. Thousands of square miles of pure forest of this species occur in Oregon, Washington, and British Columbia. Here the trees stand even, like wheat in a grain field, the tallest reach four hundred feet, the redwood its only rival. Nowhere but in the redwood forests is there such a heavy stand of timber on this continent. No forest tree except sequoias equals the Douglas spruce in massiveness of trunk and yield of straight-grained lumber.

The genus *pseudotsuga* stands botanically in a position intermediate between firs and hemlocks. Our tree giant is as often called the Douglas fir as Douglas spruce. The lumberman sells the output of his mills under the trade name, "Oregon pine." This is perhaps the best known lumber in all the Western country. It has a great reputation abroad, where timbers of the largest size are used for masts, spars, piles for wharves and bridges, and for whatever uses heavy timbers are needed. The wood is stronger in proportion to its weight than that of any other large conifer in the country. It is tough, durable, and elastic. Its only faults are its extreme hardness and liability to warp when cut into boards. These faults are noted only by carpenters who use the wood for interior finish of houses. "Red pine" it is called in regions of the Great Basin, where the trees grow smaller than on the Coast, and are put to general lumber purposes. It is variable in quality, but always pale yellow, striped with

red, and handsomely wavy when quarter-sawed; distractingly so in the "slash grain," oftenest seen in the interior finish of the typical California bungalow.

The living tree is a superb, broad-based pyramid, bearing a load of crowded drooping branches, where it has a chance to assume its normal habit. A delicate lace-like drooping spray of yellowish or bluish green leaves, flat, spreading at right angles from the twig, gives the Douglas spruce its hale, abundant vigor. The dark red staminate flowers glow in late winter against the yellow foliage mass of the new leaves; but even the flowers are not so showy as the drooping cones, two to four inches long, their plain scales adorned with bracts, notched and bearing a whip that extends half an inch beyond the scales. Blue-green, shading to purple, with red-lipped scales and bright green bracts, these cones are truly the handsomest ornaments worn by any tree.

Finally, this paragon of conifers surprises Eastern nurserymen by outstripping other seedlings in vigor and quickness of growth. Rocky Mountain seed does best. The Oregon trees furnish seed to European nurseries and seedlings from Europe grow quickly into superb ornamental trees.

THE HEMLOCKS

Unlike any other conifer, the hemlock mounts its evergreen leaves on short petioles, jointed to projecting, horny brackets on the twig. At any season this character determines the family name of a group of exceptionally graceful pyramidal conifers. The Eastern hemlocks have their leaves arranged in a flat spray, silvery white under-

neath, by pale lines on the underside of the flat blunt-pointed blade (*See illustration, page 246*). An abundance of pendent cones is borne annually. The wood of hemlocks is comparatively worthless but the bark is rich in tannin, and so the tree is important in the leather trade.

The Hemlock

Tsuga Canadensis, Carr.

The hemlock lifts its dark green, feathery spray above the sturdy trunk into a splendid broad pyramid. In all rocky uplands from Nova Scotia to Alabama and west to Minnesota, the drooping lower branches sweep the ground, and the tree is often half buried in snow. But in spring every twig is dancing and waving yellow plumes of new foliage, the picture of cheerfulness as the sunlight sifts through the tree-tops. In May the new blossoms sprinkle all the leafy twigs—the staminate, yellow; the pistillate, pale violet. Looking up from below, one sees a charming iridescent effect when the blossoms add their color to the shimmering silver which lines the various platforms of foliage. The little red-brown cones cling to the twigs all winter, slowly parting their scales to release the winged seeds. Squirrels climb the trees in the fall and cut off these cones to store away for winter use.

"Peelers" go into the woods in May, when the new growth is well started and the bark will peel readily. They fell and strip hemlock trunks and remove the bark in sheets, which are piled to dry and be measured like cordwood, and later shipped to the tanneries. The cross-grained coarse wood is left to rot and feed forest fires. Locally, it is useful for the timbers of houses and barns, be-

cause it is rigid and never lets go its hold upon a nail or spike.

The Western Hemlock

T. heterophylla, Sarg.

The Western hemlock is a giant that dominates other trees in the Western mountain forests, famous for their giants of many different names. It is a noble pyramidal tree that reaches two hundred feet in height and a maximum trunk diameter of ten feet. Its heavy horizontal branches droop and hold out feathery tips as light and graceful in the adult monarch as in the sapling of a few years' growth. The characteristic hemlock foliage, lustrous green above and pale below, is two-ranked by the twisting of the slender petioles.

From southeastern Alaska, eastward into Montana and Idaho, and southward to Cape Mendocino in California, this tree climbs from the lowlands to an altitude that exceeds a mile. Wherever there are rich river valleys and the air is humid, this hemlock is superb, the delight of artists and lumbermen. At its highest range it becomes stunted, but always produces its oval, pointed cones in abundance.

Its wood, the strongest and most durable in the hemlock family, is chiefly used in buildings, and the bark for tanning.

The Mountain Hemlock

T. Martensiana, Sarg.

The mountain hemlock of the West is called by John Muir "the loveliest evergreen in America." Sargent endorses this judgment with emphasis. It grows at high

altitudes, fringing upland meadows, watered by glaciers, with groves of the most exquisite beauty. The sweeping, downward-drooping branches, clothed with abundant pea-green foliage, silver-lined, resist wind storms and snow burdens by the wonderful pliancy of their fibres. In early autumn the trees are bent over so as to form arches. Young forests are thus buried out of sight for six months of the year. With the melting of the snow they right themselves gradually, and among the new leaves appear the flowers, dark purple cones and staminate star-flowers, blue as forget-me-nots. Three-angled leaves, whorled on the twig, and cones two to three inches long, set this hemlock apart from its related species, but the leaf-stalk settles once for all the question of its family name.

THE SEQUOIAS

Nowhere else in the world are conifers found in such extensive forests and in such superlative vigor and stupendous size as in the states that border the Pacific Ocean. California is particularly the paradise of the conifers. All of the species that make the forests of the Northwest the wonder of travelers and the pride of the states are found in equally prodigal size and extent in California. To these forests are added groves of sequoias—the Big Tree and the redwood, the former found nowhere outside of California, the latter reaching into Oregon.

Once the sequoias had a wide distribution in the Old and the New World. With magnolias and many other luxuriant trees found in warm climates, five species of sequoia extended over the North Temperate zone in both hemi-

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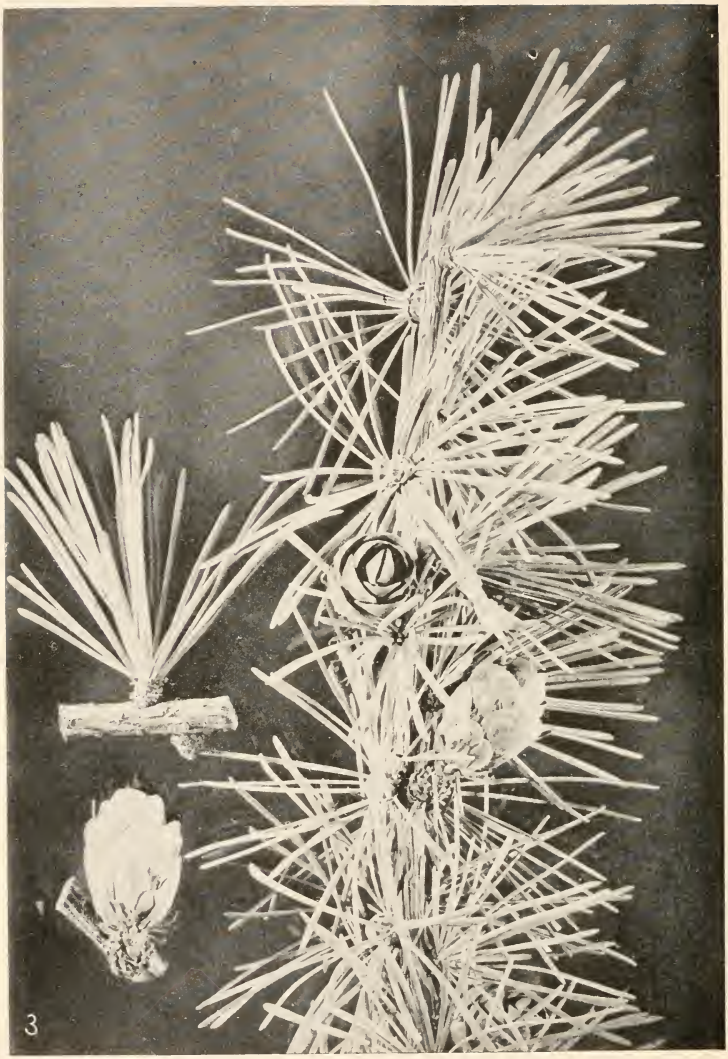
THE FLAT, FROND-LIKE SPRAY OF THE ORNAMENTAL ARBOR VITÆ



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FRUIT AND LEAVES OF THE AMERICAN LARCH

spheres, reaching even to the Arctic Circle. The glacial period transformed the climate of the world and destroyed these luxuriant northern forests under a grinding continuous glacier. The rocks of the tertiary and cretaceous periods preserved in fossils the story of these pre-glacial forests. Two of the species of sequoia escaped destruction in tracts the ice sheet did not overwhelm. For ten thousand years, perhaps, the sequoia has held its own in the California groves. Indeed, both species are able to extend their present range if nature is unhindered. The three enemies that threaten sequoia groves are the axe of the lumberman, the forest fire kindled by the waste about sawmills, and the grazing flocks that destroy seedling trees.

The Big Tree

Sequoia Wellingtonia, Seem.

The Big Tree is the most gigantic tree on the face of the earth, the mightiest living creature in existence. Among the giant sugar pines and red firs it lifts a wonderfully regular, rounded dome so far above the aspiring arrow-tips of its neighbors as to make the best of them look like mere saplings. The massive trunk, clothed with red-brown or purplish bark, is fluted by furrows often more than a foot in depth. The trunk is usually bare of limbs for a hundred or two hundred feet, clearing the forest cover completely before throwing out its angular stout arms. These branch at last into rounded masses of leafy twigs, whose density and brilliant color express the beauty and vigor of eternal youth in a tree which counts its age by thousands of years already.

To see this Big Tree in blossom one must visit the high

Sierras while the snow is eight to ten feet deep upon the buttressed base of the huge trunk. It is worth a journey, and that with some hardship in it, to see these trees with all their leafy spray, gold-lined with the multitude of little staminate flowers that sift pollen gold-dust over everything, and fill the air with it. The pistillate flowers, minute, pale green, crowd along the ends of the leafy sprays, their cone scales spread to receive the vitalizing dust brought by the wind.

When spring arrives and starts the flower procession among the lower tree-tops, the spray of the Big Tree is covered with green cones that mature at the end of the second season. They are woody, two to three inches long, and spread their scales wide at a given signal, showering the surrounding woods with the abundant harvest of their minute winged seeds. Each scale bears six to eight of them, each with a circular wing that fits it for a long journey. The cones hang empty on the trees for years.

The leaves of the Big Tree are of the close, twig-hugging, scaly type, never exceeding a half inch in length on the most exuberant-growing shoots. For the most part they are from one fourth to one eighth of an inch in length, sharp pointed, ridged, curved to clasp the stem, and shingled over the leaves above.

John Muir believes there is no absolute limit to the existence of any tree. Accident alone, he thinks, not the wearing out of vital organs, accounts for their death. The fungi that kill the silver fir inevitably before it is three hundred years old touch no limb of the Big Tree with decay. A sequoia must be blown down, undermined, burned down, or shattered by lightning. Old age and disease pass these trees by. Their heads, rising far above the spires of fir and

spruce, seem not to court the lightning flash as the lower, pointed trunks do; and yet no aged sequoia can be found whose head has not suffered losses by Jove's thunderbolts. Cheerfully the tree lets go a fraction of its mighty top, and sets about the repair of the damage, with greatly accelerated energy, as if here was an opportunity to expend the tree's pent-up vitality. It is strange to see horizontal branches of great age and size strike upward to form a part of a new, symmetrical dome to replace the head struck off or mangled by lightning. With all the signs of damage lightning has done to these tree giants of the Sierras, but one instance of outright killing of a tree is on record.

The wood of the Big Tree is red and soft, coarse, light, and weak—unfit for must lumber uses. It ought, by all ordinary standards, to be counted scarcely worth the cutting; but the vast quantity yielded by a single tree pays the lumberman huge profits, though he wastes thousands of feet by blasting the mighty shaft into chunks manageable in the sawmill. Shingles, shakes, and fencing consume more of the lumber than general construction—ignoble uses for this noblest of all trees.

The best groves of Big Trees now under government protection are in the grand Sequoia National Park. Near the Yosemite is the famous Mariposa Grove that contains the "grizzly giant" and other specimen trees of great age and size. More than half of the Big Trees are in the hands of speculators and lumber companies. Exploitation of nature's best treasure is as old as the human race. The idea of conservation is still in its infancy.

The ruin by the lumbering interests of a sequoia grove means the drying up of streams and the defeat of irrigation projects in the valleys below. Big Trees inhabit only areas

on the western slopes of the Sierras. Wherever they grow their roots have made of the deep soil a sponge that holds the drainage of melting snowbanks and doles it out through streams that flow thence to famishing, hot, wind-swept plains and valleys. When the trees are gone, turbulent, short-lived spring floods exhaust the water supply and do untold damage in the lowlands.

Big Trees have not succeeded in cultivation in our Eastern states, but for many years have been favorites in European gardens and parks. In the native groves the seedlings do not show the virility of the redwoods, though to the south the range of the species is being gradually extended. No tree is more prodigal in seed production and more indifferent, when mature, to the ills that beset ordinary forest trees; yet government protection must be strengthened, private claims must be bought, and scientific forestry maintained in order to prevent the extinction of the species, with the destruction of trees that are, as they stand to-day, the greatest living monuments in the world of plants.

The Redwood

S. sempervirens, Endl.

The redwood comes down to the sea on the western slopes of the Coast Range, from southern Oregon to Monterey County in California, tempting the lumberman by the wonderful wealth and accessibility of these groves of giant trees. The wood is soft, satiny, red, like the thick, fibrous, furrowed bark that clothes the tall, fluted trunks.

Redwoods are taller than Big Trees, have slenderer trunks and branches and a more light and graceful leaf-

spray. The head is pyramidal in young trees, later becoming irregular and narrow, and exceedingly small in forests by the crowding of the trees and the death of lower branches. The leaves on the terminal shoots spread into a flat spray, two-ranked, like those of a balsam fir. Each blade is flat, tapering to both ends, and from one fourth to one half an inch in length. Awl-shaped and much shorter leaves are scattered on year-old twigs, back of the new shoots, resembling the foliage of the Big Tree.

The cones are small and almost globular, maturing in a single season, scarcely an inch long, with three to five winged seeds under each scale. Seedling redwoods come quickly from this yearly sowing, and thrive under the forest cover, unless fire or the trampling feet of grazing flocks destroy them. After the lumberman, the virile redwood sends up shoots around the bleeding stumps, thus reinforcing the seedling tree and promising the renewal of the forest groves in the centuries to come.

Redwood lumber is the most important building material on the Pacific Coast. The hardest and choicest wood comes in limited quantities from the stumps which furnish curly and birdseye wood, used by the makers of bric-à-brac and high-priced cabinet work. Shingles, siding, and interior finish of houses consume quantities of the yearly output of the mills. Demand for fence posts, railway ties and cooperage increases. Quantities of lumber are shipped east to take the place of white pine no longer obtainable.

In cultivation the redwood is a graceful, quick-growing, beautiful evergreen, successful in the Southeastern states, and often met in European parks and gardens. Weeping forms are very popular abroad.

Government and state protection has made sure the safeguarding for coming generations of some groves of redwoods, containing trees whose size and age rival those of the most ancient Big Trees. But the fact that the redwood, restricted on the map to such a limited territory, is the most important timber tree on the Coast, is a blot upon our vaunted Democracy, which has allowed the cunning of a few small minds to defeat the best interests of the whole people and rob them of forest treasure which might yield its benefits continuously, if properly managed. Government purchase of all sequoia-bearing land, followed by rational methods of harvesting the mature lumber and conserving the young growth, is the ideal solution of the problem. Such a plan would assure the saving of the monumental giants.

THE ARBOR-VITAES

Minute, scale-like leaves, four-ranked, closely overlapping, so as to conceal the wiry twig, mark the genus *thuya*, which is represented in America by two species of slender, pyramidal evergreen trees, whose intricately branched limbs terminate in a flat, open spray (*see illustration, page 262*). "Tree of Life" is the English translation, but the Latin name everywhere is heard.

Eastern Arbor-vitae

Thuya occidentalis, Linn.

The Eastern arbor-vitae, called also the white cedar, is found in impenetrable pure forest growth, from Nova

Scotia and New Brunswick northwestward to the mouth of the Saskatchewan River, always in swampy regions, or along the rocky banks of streams. In the East it follows the mountains to Tennessee, and from Lake Winnipeg it extends south to middle Minnesota and northern Illinois. In cultivation it is oftenest seen as an individual lawn and park tree, or in hedges on boundary lines. It submits comfortably to severe pruning, is easily transplanted, and comes readily from seed. Plantations grow rapidly into fence posts and telegraph poles. The wood is durable in wet ground, but very soft, coarse, and brittle.

The Red Cedar

T. plicata, D. Don.

The red cedar or canoe cedar is the giant arbor-vitae of the coast region from British Columbia to northern California and east over the mountain ranges into Idaho and northern Montana. Its buttressed trunk is a fluted column one hundred and fifty to two hundred feet high in western Washington and Oregon, along the banks of mountain streams and in the rich bottom land farther seaward. The leaves in a flat spray at once distinguish this tree from any other conifer, for they are pointed, scale-like, closely overlapping each other in alternate pairs.

The clustered cones, with their six or eight seed-bearing scales, seem absurdly small fruits on so huge a tree. None exceeds one half an inch in height, but their number makes up for size deficiency and the seed crop is tremendous.

The Alaskan Indian chooses the tall bole of a red cedar for his totem pole, and from the massive butt hollows

out the war canoe and "dug-out" which solve his problems of transportation in summer. Durability is the chief merit of this soft, brittle wood, which is easily worked with the Indian's crude tools. The bark of the tree furnishes the walls of the Indian huts and its inner fibre is the raw material of his cordage—the harness for his dog team, his nets and lines for fishing; and it is the basis of the squaw's basket-weaving industry.

This is the best arbor-vitae for ornamental planting. Its success in Europe is very striking, and from European nurseries it has been successfully re-introduced into the United States, where it is hardy and vigorous. But it fails when taken directly into the North Atlantic states. It must come in *via* Europe, as nearly all West Coast trees have to do in order to succeed.

THE INCENSE CEDAR

One tree, so magnificent in proportions that it ranks among the giants in our Western forests, stands as the sole American representative of its genus. Its nearest relatives are the arbor-vitaes, sequoias, and the bald cypress of the South.

The incense cedar (*Librocedrus Decurrens*, Torr.) has its name from its resinous, aromatic sap. The tree, when it grows apart from others, forms a perfect tapering pyramid, with flat, plume-like sprays that sweep downward and outward with wonderful lightness and grace. The leaves are scale-like, closely appressed to the wiry twigs, in four ranks, bright green, tinged with gold in late winter, by the abundance of the yellow staminate flowers. The cones are small, narrowly pointed, made of few paired

scales, each bearing two seeds. The bark is cinnamon-red in color. The trees occur scattered among other species in open forests from three thousand to six thousand feet above the sea, reaching a height of two hundred feet and a trunk diameter of twelve feet on the Sierra Nevada glacial moraines.

The lumber resembles that of arbor-vitae, and is used for the same purposes. In cultivation the tree is hardy and thrives in parks in the neighborhood of New York. In Europe it has long been a favorite.

THE CYPRESSES

Three genera of pyramidal conifers, with light, graceful leaf-spray, and small woody cones, held erect, compose the group known as cypresses. All have found places in horticulture, for not one of them but has value for ornamental planting. Some species have considerable lumber value.

The Monterey Cypress

Cupressus macrocarpa, Cord.

The Monterey cypress is now restricted to certain ocean-facing bluffs about Monterey Bay in California. These trees are derelicts of their species. Wind-beaten into grotesqueness of form, unmatched in any other tree near the sea-level, their matted and gnarled branches make a flat and very irregular top above a short, thick, often bent and leaning trunk. Clusters of globular cones stud the twigs behind the leafy spray composed of thread-like wiry twigs, entirely covered with scaly, four-ranked leaves.

In cultivation this cypress grows into a luxuriant, pyramidal tree, often broadening and losing its symmetry, but redeeming it by the grace of its plume-like, outstretched branches. One by one the native cypresses on the crumbling bluffs will go down into Monterey Bay, for the undermining process is eating out their foundations. Wind and wave are slowly but surely sealing their doom. But the species is saved to a much wider territory.

The European Cypress

C. sempervirens, Linn.

A tall, narrow pyramid of sombre green, the European cypress is found in cemeteries in south Europe and everywhere, planted for ornament. This is the classic cypress, a conventional feature of Italian gardens, the evergreen most frequently mentioned in classical literature. Slow-growing and noted for its longevity, it was the symbol of immortality. It is hardy in the South-Atlantic and Pacific-Coast states, and is a favorite evergreen for hedges in the Southwest.

Three other members of the genus occur on mountain foothills—one in Arizona, two in California—all easily recognized by their scale-like leaves and button-like woody cones, which require two years to mature.

The White Cedar

Chamaecyparis Thyoides, Britt.

The genus *chamaecyparis* includes three American species, of tall, narrow pyramidal habit and flat leaf-spray like that of the arbor-vitae. Annual erect globular cones of few, woody scales, produce one to five seeds under each.

This white cedar is the swamp-loving variety of the Atlantic seaboard—its range stretches from Maine to Mississippi. The durability of its white wood gives it considerable importance as a lumber tree. It is particularly dependable when placed in contact with water and exposed to weather. Cedar shingles, fence posts, railroad ties, buckets, and other cooperage consume quantities each year. The trees are important ornamental evergreens, planted for their graceful spray and their dull blue-green leaves. Their maximum height is eighty feet.

The Lawson Cypress

C. Lawsoniana, A. Murr.

The Lawson cypress lifts its splendid spire to a height of two hundred feet, on the coast mountains of Oregon and California, forming a nearly continuous forest belt twenty miles long, between Point Gregory and the mouth of the Coquille River. Spire-like, with short, horizontal branches, this species bears a leaf-spray of feathery lightness, bright green, from the multitude of minute paired leaf-scales, and adorned with the clustered pea-sized cones, which are blue-green and very pale until they ripen.

The wood of this giant cypress is used in house-finishing and in boat-building; for flooring, fencing, and for railroad ties.

The Bald Cypress

Taxodium distichum, Rich.

The bald cypress is the one member of the cypress group that sheds its foliage each autumn, following the example of the tamarack. In the Far South, river swamps are often

covered with a growth of these cypresses whose trunks are strangely swollen at the base, and often hollow. The flaring buttresses are prolonged into the main roots, which form humps that rise out of the water at some distance from the tree. These "cypress knees" are not yet explained, though authorities suspect that they have something to do with the aëration of the root system.

Inundated nine or ten months of the year, these cypress swamps are often dry the remaining time, and it is a surprise to Southerners to find these trees comfortable and beautiful in Northern parks. Cleveland and New York parks have splendid examples.

The leaves of the bald cypress are of two types. They are scale-like only on stems that bear the globular cones. On other shoots they form a flat spray, each leaf one half to three fourths of an inch long, pea-green in the Southern swamps, bright yellow-green on both sides in dry ground, turning orange-brown before they fall. The twigs that bear these two-ranked leaves are also deciduous, a unique distinction of this genus.

Cypress wood is soft, light brown, durable, and easily worked. Quantities of it are shipped north and used in the manufacture of doors and interior finishing of houses, for fencing, railroad ties, cooperage, and shingles.

THE JUNIPERS

The sign by which the junipers are most easily distinguished from other evergreens, is the juicy berries instead of cones. In some species these are red, but they are mostly blue or blue-black. Before they mature it is easy to see

the stages by which the cone-scales thicken and coalesce, instead of hardening and remaining separate, as in the typical fruit of conifers.

Juniper leaves are of two types: scale-like in opposite pairs, pressed close to the twig, as in the cypresses; and stiff, spiny, usually channelled leaves, which stand out free from the twig in whorls of threes.

The wood is red, fragrant, durable, and light.

The Dwarf Juniper

Juniperus communis, Linn.

The dwarf juniper departs from the pyramidal pattern and forms a loose, open head above a short, stout trunk. The slender branchlets are clothed with boat-shaped leaves which spread nearly at right angles from the twigs in whorls of three. Each one is pointed and hollowed, dark green outside, snowy white inside, which is really the upper side of the leaf. It requires three years to mature the bright blue berries, and they hang on the tree two or three years longer. Each fruit contains two or three seeds, and these require three years to germinate.

It is plain to see that time is no object to this slow-growing dwarf juniper, found in both the Eastern and Western Hemispheres, covering vast stretches of waste land. From Greenland to Alaska it is found and south along the highlands into Pennsylvania, New Mexico, and California. Its hardiness gives it importance as a cover for waste land on seashores and for hedges and windbreaks in any exposed situation. It is a tree reaching thirty feet in height on the limestone hills of southern Illinois. In other situations it is usually a sprawling shrubby thing, the cringing parent

of a race of dwarf junipers, known in many and various horticultural forms.

The Western Juniper

J. occidentalis, Hook.

The giant of its race is the Western juniper, one of the patriarchial trees of America, ranking in age with the sequoias. Never a tall tree, it yet attains a trunk diameter of ten feet, and an age that surely exceeds two thousand years. At elevations of seven to ten thousand feet this valiant red cedar is found clinging to the granite domes and bare glacial pavements where soil and moisture seem absolutely non-existent. Sunshine and thin air are abundant, however, and elbow room. Upon these commodities the tree subsists, crouching, stubbornly clinging, while a single root offers foothold, its gnarled branches picturesque and beautiful in their tufts of gray-green leaves. Avalanches have beheaded the oldest of these giants, but their denuded trunks throw out wisps of new foliage with each returning spring. When they succumb, their trunks last almost as long as the granite boulders among which they are cast by the wind or the ice-burden that tore them loose.

The stringy bark is woven into cloth and matting by the Indians, and the fine-grained, hard, red wood finds no better use than for the mountaineer's fencing and fuel.

The Eastern Red Cedar

J. Virginiana, Linn.

The Eastern red cedar is a handsome, narrow pyramid in its youth, often becoming broad and irregular, or

round-topped above a buttressed, twisted trunk, as it grows old. The scale-like leaves are four-ranked, blue-green when young, spreading, and sometimes three fourths of an inch long, on vigorous new shoots. The dark blue berries are covered with a pale bloom and have a resinous, sweet flesh. This juniper is familiar in abandoned farms and ragged fence-rows, becoming rusty brown in foliage to match the stringy red bark in winter time. The durable red wood is used for posts and railroad ties, for cedar chests and pencils. The tree is profitably planted by railroad companies, as cedar ties are unsurpassed. In cultivation the tree forms an interesting, symmetrical specimen, adapted to formal gardens. (*See illustration, page 230.*)

The Red Juniper

J. Barbadensis, Linn.

The red juniper, much more luxuriant than its close relative of the North, is the handsomest juniper in cultivation. Its pyramid is robbed of a rigid formal expression by the drooping of its fern-like leaf-spray. The berries are silvery white and abundant. The wood is used principally for pencils. This species grows in the Gulf states.

THE LARCHES, OR TAMARACKS

The notable characteristic of the small genus, *larix,* is that the narrow leaves are shed in the autumn. Here is a tall pyramidal conifer which is not evergreen. It bears an annual crop of small woody cones, held erect

on the branches, and the leaves are borne in crowded clusters on short lateral spurs, except upon the terminal shoots, where the leaves are scattered remotely but follow the spiral plan. Larch wood is hard, heavy, resinous, and almost indestructible. The tall shafts are ideal for telegraph poles and posts.

The Tamarack

Larix Americana, Michx.

The tamarack or American larch (*see illustration, page 263*) goes farther north than any other tree, except dwarf willows and birches. Above these stunted, broad-leaved trees pure forests of tamarack rise, covering Northern swamps from Newfoundland and Labrador to Hudson Bay and west across the Rocky Mountains, the trees dwindling in size as they approach the arctic tundras, the limit of tree growth. The wood of these bravest of all conifers is a God-send over vast territories where other supply of timber is wanting. The tough roots of the larch tree supply threads with which the Indian sews his birch canoe.

In cultivation the American species is too sparse of limb and foliage to compete with the more luxuriant European larch, yet it is often planted. Its fresh spring foliage is lightened by the pale yellow of the globular staminate flowers and warmed by the rosy tips of the cone flowers. In early autumn the plain, thin-scaled cones, erect and bright chestnut-brown, shed their small seeds while the yellow leaves are dropping, and the bare limbs carry the empty cones until the following year.

The Western Larch

L. occidentalis, Nutt.

The Western larch is the finest tree in its genus, reaching six feet in trunk diameter and two hundred feet in height, in the Cascade forests from British Columbia to southern Oregon and across the ranges to western Montana. This tree has the unusual distinction of exceeding all conifers in the value of its wood, which is heavy, hard, strong, dense, durable, of a fine red that takes a brilliant polish. It is used for furniture and for the interior finish of houses. Quantities of it supply the demand for posts and railroad ties, in which use it lasts indefinitely, compared with other timber.

PART IX

THE PALMS

Palms are tropical plants related to lilies on one hand and grasses on the other. One hundred genera and about one thousand species compose a family in which tree forms rarely occur. A few genera grow wild in the warmest sections of this country, and exotics are familiar in cultivation, wherever they are hardy. The leaves are parallel-veined, fan-shaped, or feather-like, on long stalks that sheath the trunk, splitting with its growth. The flowers are lily-like, on the plan of three, and the fruits are clustered berries, or drupes.

Sago, tapioca, cocoanuts, and dates are foods derived from members of this wonderful family. The fibres of the leaves supply thread for weaving cloth and cordage to the natives of the tropics, where houses are built and furnished throughout from the native palms.

The royal palm, crowned with a rosette of feather-like leaves, each ten to twelve feet long, above the smooth, tall stems, is a favorite avenue tree in tropical cities. In Florida it grows wild in the extreme southwest, but is planted on the streets of Miami and Palm Beach. Its maximum height is one hundred feet.

In California the favorite avenue palm of this feather-leaved type is the Canary Island palm, whose stout trunk, covered with interlacing leaf-bases, wears a crown of

plumes that reach fifteen feet in length and touch the ground with their drooping tips. Huge clusters of bright yellow, dry, olive-shaped berries ripen in midsummer.

The date palm of commerce, once confined to the tropical deserts of Asia Minor and North Africa, has been successfully established by the Government in hot, dry localities of the Southwest. Fruit equal to any grown in plantations of the Old World is marketed now from the Imperial and Coachella valleys in California, and from orchards near Phoenix, Arizona. Dry air and a summer temperature far above the hundred degree mark is necessary to insure the proper sugar content and flavor in these fruits, which are borne in huge clusters and ripen slowly, one by one.

Fan-shaped leaves plaited on the ends of long stalks that are usually spiny-edged are borne by the stocky Florida palmettos and the tall desert palm of California, planted widely in cities of the Southwest and in Europe. Several genera of this fan-leaved type are represented in palm gardens, and in the general horticulture of warm regions of this country.

THE END

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